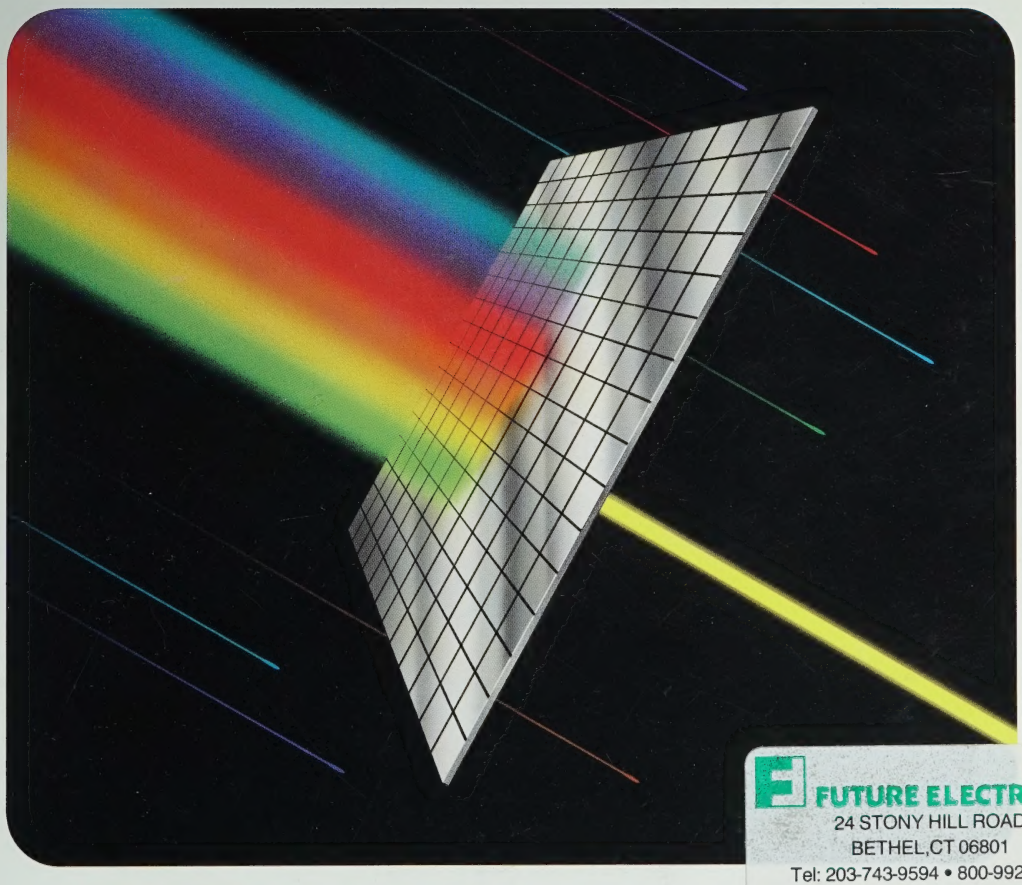
# RF & MICROWAVE PRODUCTS CATALOG

CATALOG NO. M-10-A



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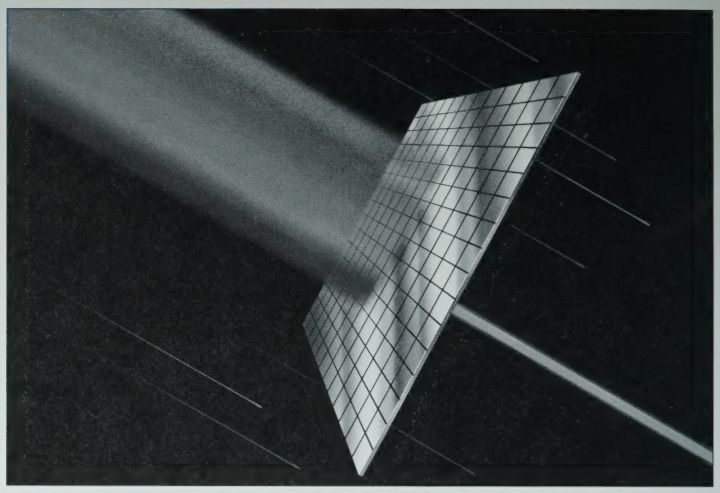
FUTURE IS UNIQUE

muRata ERIE®
MURATA ERIE NORTH AMERICA

# RF & MICROWAVE PRODUCTS

Here at the State College facility of Murata Erie, state-of-the-art products are designed and manufactured for RF communications applications. A comprehensive line of filters, oscillators, duplexers and more are available in standard or custom configurations tailored to meet exacting customer specifications. And, Murata Erie is backed by over 40 years of experience in supplying the industry with high quality products. Growth over the years has been built on quality, ingenuity, flexibility and competitive pricing. For requirements that demand that stringent specifications be met, Murata Erie will assist the customer in defining parameters that meet the design criteria of the application. It is this partnership that allows Murata Erie to take your project from the initial concept through to the finished package. Murata Erie will provide unique solutions to your production and applications requirements.



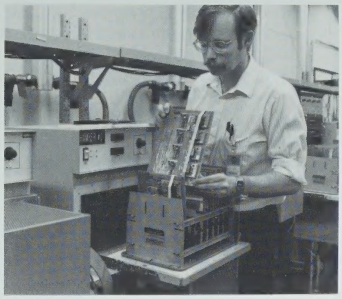
| PRODUCTS | Page | APPLICATIONS: CELLULAR/CORDLESS PHONE | GPS/MSAT/DAB | HIGH-PERFORMANCE COMPUTERS | SPREAD SPECTRUM TECHNOLOGY | DATA & COMPUTER COMMS | VSAT | MILITARY/GOVT/RADAR |
|---|---|---|---|---|---|---|---|---|
| CRYSTAL PRODUCTS | 5-29 | X | X | X | | X | X | X |
| RESOMICS | 30-42 | | | | | | X | X |
| MICROWAVE OSCILLATORS | 43-46 | X | X | | X | | X | |
| GIGAFIL® | 47-51 | X | X | | X | | X | X |
| ISOLATORS | 52-53 | X | | | | | | |
| MONOLITHIC FILTERS | 54-55 | X | X | | X | | | |
| MONOLITHIC DELAY LINES | 56-57 | | | X | | X | | |
| GPS ANTENNA | 58-59 | | X | | | | | |
| CONNECTORS | 60-63 | X | X | | X | | X | |

Application specific catalogs are also available.

# CUSTOM DESIGNS

Working together from concept through engineering, development and production creates close partnerships between Murata Erie and our customers. The Engineering Group at Murata Erie is composed of individuals with substantial experience in many diverse technical areas. This broad spectrum of technical expertise includes low and high frequency oscillator designs, analog and digital systems design, ceramic materials technology, thru-hole and surface mount package design and hybrid circuit technology. On-going consulting relationships with several universities and the availability of extensive corporate research and development facilities ensure that Murata Erie engineers are constantly kept abreast of state-of-the-art technology.

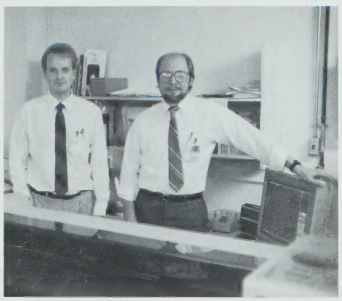
By working with the customer during the conceptual phase of the project, Murata Erie can suggest and define parameters that meet the design and cost/performance criteria specified by application requirements. By utilizing HP computers, engineers can select the optimum design approach to meet specific requirements. Prototypes are then constructed for verification and validation of the design approach and producibility, thus facilitating efficient design implementation. Production efficiency is augmented by state-of-the-art computer aided test (CAT) systems. Reliability and quality are also enhanced through the use of these systems.



The concept, design and manufacturing cycle represent Murata Erie's commitment to the customer. The partnership created facilitates the design and production of cost effective, reliable and high quality products that meet the most difficult application requirements.

# CUSTOMER SUPPORT

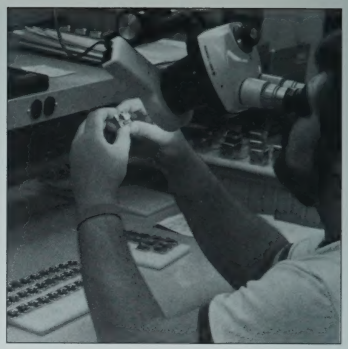
Murata Erie is committed to providing customer service and/or application assistance. When you need assistance, from quotes to order status, our knowledgeable customer service staff, supported by a fully integrated database, will provide fast response. If you have difficult frequency control problems, our engineering staff is available to assist you by evaluating the design approach early in your program. We can often save you time, money and effort by suggesting optimum frequencies or existing products that are presently being produced in volume.



# QUALITY CONTROL

Murata Erie's Quality Assurance Department is charged with the responsibility of maintaining product quality at a level equal to the company's high standards of performance and workmanship. The department is vested with the authority to exercise control over every phase of the manufacturing process. This control extends from incoming inspection of purchased material to in-process inspection, inspection of final product, packaging and shipping.

Murata Erie's Quality Department features a certified resident MIL-STD-2000 instructor/examiner assuring that all products can be inspected to the requirements of MIL-STD-2000. Calibration of measuring and test equipment is accomplished through compliance with MIL-STD-45662.



# ENVIRONMENTAL TESTING

Product quality is guaranteed by our Quality Assurance Program. Many oscillators are custom designed to meet your needs.

Standard oscillator design parameters are:

**Storage Temperature:** −55°C to +85°C (to +125°C Optional)

**Vibration:** 10G's, 10 to 500Hz MIL-STD-202F, Method 204D

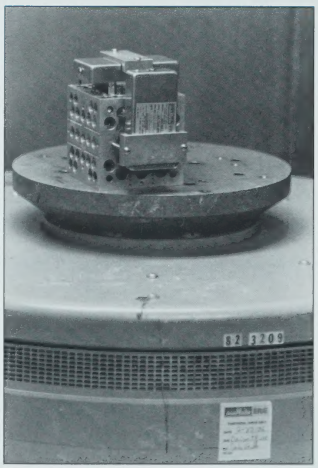
**Shock:** 100G's, 6msec MIL-STD-202F, Method 213B, Test Condition I

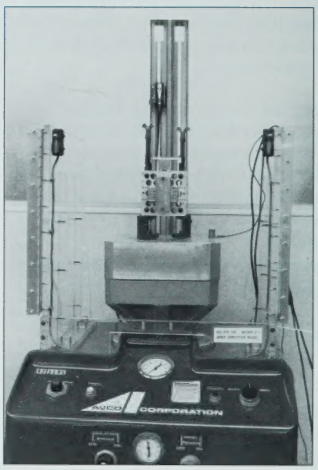
**Altitude:** Sea Level to space per MIL-STD-202, Method 105

More stringent specification levels are available. Consult our factory for details.

Moisture resistance, corrosive atmospheres, resistance to solvents and other environmental conditions encountered by oscillators should be listed so that we may design units to meet your requirements.

Standard environmental tests are conducted on premises in the Corporate QA laboratory. Specialized environmental tests are sometimes conducted at outside, independent testing laboratories.





## MURATA ERIE MANUFACTURES A COMPLETE LINE OF OSCILLATORS

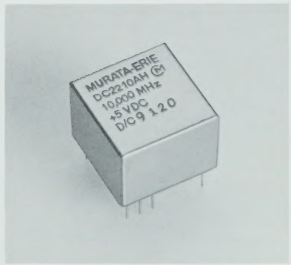
The majority of our oscillators are crystal controlled, but we also manufacture LC types. We are a volume producer of TTL, CMOS, ECL and Sine Wave Clock Oscillators for the computer and communication industries. Excellent frequency stability is achieved with TCXO, Temperature Compensated Crystal Oscillators and OCXO, Ovenized (Proportional Control) Crystal Oscillators. Special requirements are met with VCXO, Voltage Controlled Crystal Oscillators, which can be frequency modulated, with combinations of the basic types such as the TC/VCXO or OC/VCXO and with low power, high stability Digitally Compensated Crystal Oscillators, DCXO. High frequency clock oscillators utilizing saw resonators are also available. Murata Erie has full-line expertise from economy models to sophisticated, high stability, very low phase noise oscillators that are used as standards for microwave transmitters. Our oscillator production lines are closely monitored by Quality Control through Incoming, In-Process and Final Inspections.

Quality Control is guaranteed by our quality assurance program described on Page 4. Murata Erie's oscillator Q.C. Program is regularly audited by major military electronic contractors for whom we supply oscillators, assuring maintenance of our high performance standards.

**Oscillators can be custom designed to meet your needs. Send us your specifications (see Page 8).** We have full-line capability backed by a well staffed engineering department. Murata Erie will assist you in defining your oscillator requirements and provide the support to take your project from the conceptual stage through implementation, including fast prototype turnaround.

## OSCILLATOR TECHNICAL PERFORMANCE

If you have a formal specification, send us a copy for quotation. If not, make a copy of our specification and RFQ form on Page 8 to help you specify an oscillator to meet your requirements. Select those specifications relevant to your application; cost increases as electrical and mechanical requirements become more stringent. Murata Erie is in business to produce a cost effective product which will meet all of your oscillator requirements. Since tradeoffs exist in many instances, we are always happy to quote options when cost/performance or cost/size tradeoffs exist. Attach additional sheets to our specification sheet if necessary.



# CRYSTAL OSCILLATOR STANDARDS

The following material briefly describes our in-house standards and offers some cost/performance tradeoffs.

## ENVIRONMENTAL CONDITIONS

See Page 4.

## FREQUENCY RANGE

From less than 1Hz to 1GHz, Murata Erie's designs frequently center around the "AT" cut crystals, but "SC," "IT," and other cuts are used for certain applications. Saw resonators are utilized in high frequency clock oscillators. Fundamental mode crystals from 3MHz and overtones from 5 to 400MHz are utilized in the oscillators. This range is extended through the use of dividers and multipliers. Oscillators in the microwave range are available through the Murata Erie's RF and Microwave Products Group in State College, Pennsylvania.

## FREQUENCY STABILITY

Is generally defined in two ways:

1.0 Total Frequency Stability—the maximum frequency excursion from the nominal for all conditions. This is usually expressed as a ± percentage centered at the nominal frequency.

$$\text{FREQUENCY STABILITY [ppm]} \equiv \frac{\triangle f\,[\text{Hz}]}{f_c\,[\text{MHz}]}$$

2.0 Specific Stabilities—

2.1 Accuracy—the frequency setting tolerance at room temperature at time of shipment. Oscillators may incorporate external adjustments for exact calibration. TCXO's typically exhibit a resolution of ±1pp $10^7$. For OCXO's, the typical resolution is to ±1pp $10^9$.

2.2 Frequency Stability Versus Temperature—a minimum/maximum change from the nominal frequency. Oscillators relying on the temperature characteristics of the "AT" crystal can be designed to meet a stability requirement as tight as ±10ppm from −10°C to +60°C. Tighter stabilities to ±0.1ppm require temperature compensation techniques. Ovenized oscillators are used for stabilities to ±5pp $10^{10}$.

2.3 Frequency Stabilities Versus Supply Voltage and Load Variation—these parameters may be improved by the use of voltage regulation and additional buffer stages. The tighter the stability requirements, the more complex the design.

2.4 Stability Versus Time—can be expressed over periods of milliseconds to years. Through use of high quality crystals typical aging rates of ±1ppm/year are achieved. For OCXO's, it is possible to achieve aging rates as low as ±5pp $10^{10}$ per day. Short term stability can be expresed as an Allan Variance over a range of gate times from less than 1msec to 10sec, or in terms of SSB phase noise in the frequency domain.

## OUTPUT CHARACTERISTICS

Oscillator output waveforms are either sine or square waves.

1.0 Sine Waves—outputs are specified by stating the amplitude of the signal (mW or $V_{RMS}$) and the nominal load impedance (typically 50 ohms or 1k ohms).

Harmonic and Sub-Harmonic distortion less than −20dBc is standard.

Deviations from the standards can be accommodated, if necessary.

2.0 Square Wave*

| | TTL | CMOS | ECL |
|---|---|---|---|
| Logic "0" Level | 0.4V Max. | 1.0V Max. | −1.89V |
| Logic "1" Level | 2.4V Min. | Vcc −1.0V | −0.89 |
| Symmetry | 40/60 | 40/60 | 40/60 |
| Load | 10 Gates | 50 pF Max. | 50 ohms to −2VDC |
| Freq. Range | 1 Hz to 100 MHz | 1 Hz to 100 MHz | 4.0 MHz to 700 MHz |

*Specify logic type to be driven

## INPUT POWER CHARACTERISTICS

Specification of input voltage and current parameters is vital for the proper design of all oscillators. Voltage, power limits and regulation should be specified for all supplies available. If no regulation is listed, ±10% will be assumed and a voltage regulation circuit incorporated if needed. For ovenized oscillators, the oven input voltage may differ from the oscillator supply with an assumed ±5% regulation.

## MECHANICAL SPECIFICATIONS

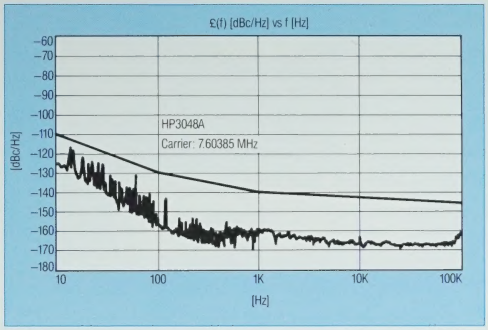
Mechanical Specifications are often unique to your application, but try to specify standard sizes and tolerances, ±0.030″ for outer dimensions and ±0.010″ to ±0.015″ for pin spacing. Specify only those dimensions that are critical and let us supply you with a completed outline drawing.

The purpose of these standards is to help you define specifications without over-designing.

## PHASE NOISE

Phase noise, which is a measure of the short term frequency fluctuations of the oscillator, is a critical parameter and the limiting factor in the performance of many systems. This is usually specified as the single sideband power density in a 1Hz bandwidth at a specified offset frequency from the carrier.

Here at Murata Erie, we use a state-of-the-art phase noise measurement system (HP3048A), which can accurately characterize the phase noise of any of our oscillators up through 18GHz. This system has a noise floor below −170dBc/Hz so that even the best sources may be measured. A typical graph produced by the HP3048A is shown.




## VOLTAGE CONTROL/VCXO

This capability allows the frequency of the oscillator to be changed via an external control voltage. The three most important parameters are:

1.0 Frequency Deviation—this is how far the center frequency will change as a function of the control voltage; usually specified in ± percentage or ppm. As the deviation is made larger, the other stabilities such as, temperature and aging will usually degrade.

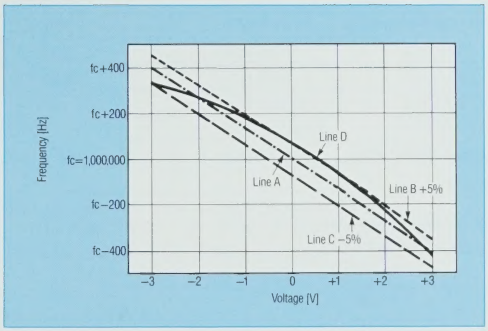
2.0 Linearity—the allowable error from the best straight line. This can be interpreted in a number of ways.

Murata Erie defines linearity per MIL-0-55310, as a ±percentage of the total deviation, for example:

a) control voltage of ±3VDC
b) deviation of ±.04% (400ppm)
c) linearity of ±5%

For a center frequency of 1.0MHz, the total deviation of ±0.04% equals 800 ppm (800Hz). Line "A" shows the ideal transfer function. Line "B" shows the upper limit, which is 5% of the total deviation (0.05 × 800Hz) above the nominal curve. Conversely, line "C" shows the lower 5% limit. Line "D" shows a typical oscillator which meets the 5% specification.

3.0 Response Slope—the slope of the frequency versus the control voltage (i.e. for a negative slope, the output frequency decreases as the control voltage increases).



# MURATA ERIE
# OSCILLATOR SPECIFICATION—RFQ FORM
# QUICK QUOTE

**1. Copy on your copier**
**2. Send us your specifications**

**OR**

**3. Dial (814) 237-1431**
**4. Ask for Product Manager**

NAME_____ TITLE_____ DATE_____

COMPANY_____ DEPARTMENT_____

STREET_____ PHONE_____ EXT._____

CITY_____ STATE_____ ZIP_____

Customer Specification Dwg. No. _____

Frequency and Stability:

Frequency_____

Stability All Conditions_____

Stability @ 25°C_____

ΔF_____ From_____ °C To_____ °C

ΔF_____ Vs ΔB + _____ %

ΔF_____ Vs Time_____

25°C Setting Tolerance_____

Frequency Adjustment_____

Power Supply:

OSC_____ ± _____ AT_____ mA

Oven_____ ± _____ AT_____ mA

Output Wave Form:

Sine ☐

Output Level_____

Harmonic Dist._____ Subs_____

Spurious_____

Load_____

Square:

☐ TTL ☐ CMOS ☐ ECL

☐ Others_____

Rise Time_____ Fall Time_____

Measured From_____ to_____

Duty Cycle_____ at_____ level

Levels: Logic "0"_____ Logic "1"_____

Load:_____

Additional Comments:_____

Environmental:

Storage Temperature_____

Vibration_____

Shock_____

Moisture_____

Seal_____

Others_____

VCXO (Freq. Control) Characteristics:

Freq. Deviation_____

Linearity_____

Control Voltage_____

Input Impedance_____

Modulation Freq._____

Response Slope_____

Special_____

Mechanical:

Size_____

Termination_____

Finish_____

Mounting_____

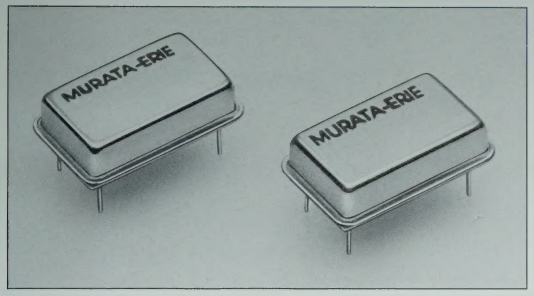
Additions_____

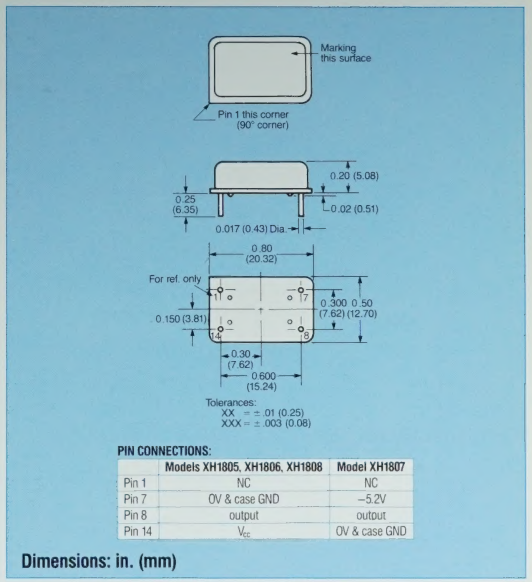
Special Notes:_____

Cost vs. Performance Trade Off:_____

Application:_____

Estimated Annual Usage:_____ Target Price:_____




**PIN CONNECTIONS:**

| | Models XH1805, XH1806, XH1808 | Model XH1807 |
|---|---|---|
| Pin 1 | NC | NC |
| Pin 7 | 0V & case GND | −5.2V |
| Pin 8 | output | output |
| Pin 14 | $V_{CC}$ | 0V & case GND |

**Dimensions: in. (mm)**

## PART NUMBERING SYSTEM

HYBRID CLOCK OSCILLATORS

XH180□ — □ □ at □

| basic model # | temperature option | stability option | exact frequency |
|---|---|---|---|

Example: XH1807 — 2 B at 25.0MHz

| ECL model | −40°C to +85°C | ±100ppm | 25.0MHz |
|---|---|---|---|

## SPECIFICATIONS

| Frequency range | TTL | CMOS | ECL | Sine Wave |
|---|---|---|---|---|
| 1.0Hz to 4.99MHz | XH1805 | XH1806 | N/A | N/A |
| 5.0MHz to 19.99MHz | XH1805 | XH1806 | XH1807 | XH1808 |
| 20.0MHz to 59.99MHz | XH1805 | XH1806 | XH1807 | XH1808 |
| 60.0MHz to 99.99MHz | XH1805 | XH1806 | XH1807 | XH1808 |
| 100.0MHz to 135.0MHz | N/A | N/A | XH1807 ④ | XH1808 ④ |
| Input voltage | +5.0VDC ±10% | +5.0VDC ±10% | −5.2VDC ±5% | +5.0VDC ±5% |
| Input current ① | 12mA Typ. | 10mA Typ. | 35mA Typ. | 25mA Typ. |
| Output voltage and Load | 0.4V max. to 2.4V min. up to 10 STD. TTL loads 1Hz to 19.99MHz<br>0.5V max. to 2.4V min. up to 10 Schottky loads 20MHz to 99.99MHz | 0.5V max. to $V_{DD}$ −0.5V min. up to 10CMOS loads | −0.89VDC ±0.18V to −1.75VDC ±0.15V (50Ω to −2.0V) | +3dBm min. into 50Ω |
| Symmetry | 55/45 max. 1Hz to 4.99MHz<br>60/40 max. 5MHz to 99.99MHz measured at 1.5V | 55/45 max. 1Hz to 4.99MHz<br>60/40 max. 5MHz to 99.99MHz measured at 50% | 60/40 max. measured at 50% | Harmonics: −20dBc max. |

**Notes:**

1. Input current is dependent on frequency.
2. Storage temperature range for all models is −62°C to +125°C.
3. Other options such as multiple outputs, enable inputs, frequency adjustment, tighter frequency tolerances and MIL-STD-883 screening are available — contact the factory for details.
4. Higher frequencies available in 24-pin DIP package.

| ABSOLUTE FREQUENCY STABILITY OPTIONS | |
|---|---|
| A | ±50ppm ( ±.005 %) |
| B | ±100ppm ( ±.01 %) |
| C | ±500ppm ( ±.05 %) |
| D | ±1000ppm ( ±.10 %) |
| E | ±10000ppm (±1.0 %) |
| F | ±25ppm ( ±.0025%) |

| OPERATING TEMPERATURE RANGE OPTIONS | |
|---|---|
| −1 | 0°C to +70°C |
| −2 | −40°C to +85°C |
| −3 | −55°C to +105°C |
| −4 | −55°C to +125°C |

## PART NUMBERING

**TC 2100 C N , FREQUENCY**

**Oscillator Type**
TC—TCXO
TV—TCVCXO
XH—Hybrid Crystal Oscillator
TH—Hybrid TCXO
SH—Hybrid SAW Oscillator
XO—Crystal Oscillator
VH—Hybrid VCXO
VO—VCXO
DC—DCXO
OC—OCXO
TCS—SMT TCXO
TVS—SMT TCVCXO

**Base No.**

**Input Voltage**
See Chart Below

**Output Type**
See Chart Below

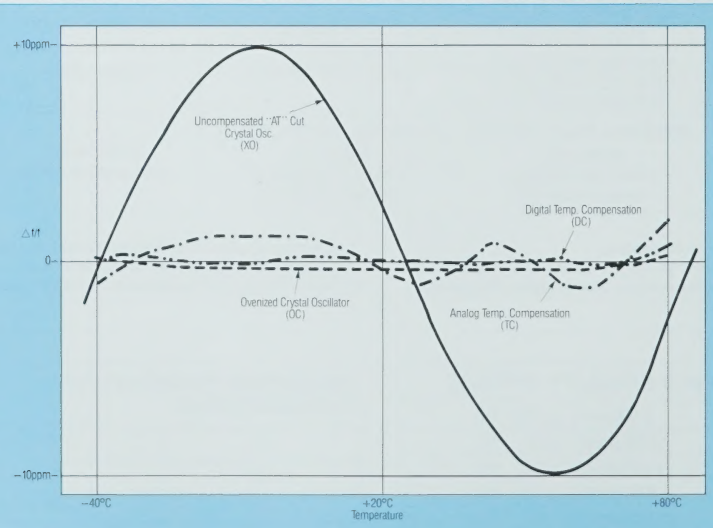
## INPUT VOLTAGE (±5% TOLERANCE STANDARD)

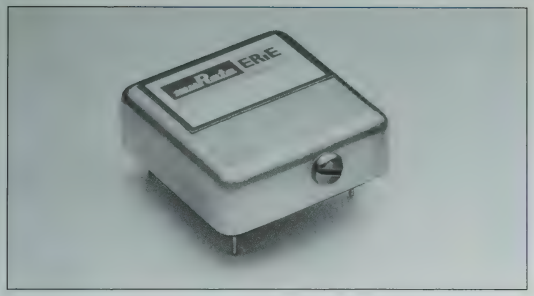
| | |
|---|---|
| A | +5.0VDC |
| B | +7.5VDC |
| C | +10.0VDC |
| D | +12.0VDC |
| E | +15.0VDC |
| F | +24.0VDC |
| G | +28.0VDC |
| H | −5.2VDC |
| J | −12.0VDC |
| K | −4.5VDC |
| L | +4.0VDC |

## OUTPUT TYPE

| | |
|---|---|
| T | TTL |
| C | CMOS |
| H | "HC" CMOS |
| E | ECL "10KH" |
| F | ECL "100K" |
| G | SINE, 0dBm, 50Ω LOAD |
| J | SINE, +3dBm, 50Ω LOAD |
| K | SINE, +7dBm, 50Ω LOAD |
| L | SINE, +10dBm, 50Ω LOAD |
| M | SINE, +13dBm, 50Ω LOAD |
| N | SINE, $1V_{p-p}$, 1KΩ LOAD |
| P | 0dBm min., 50Ω LOAD |
| Q | $1V_{p-p}$ Min. (DC-CUT), 10KΩ in parallel with 10pF LOAD |
| R | $1V_{p-p}$ Min. (DC-CUT), 20KΩ in parallel with 10pF LOAD |

## RELATIVE FREQUENCY STABILITY OF TYPICAL CRYSTAL OSCILLATOR TYPES

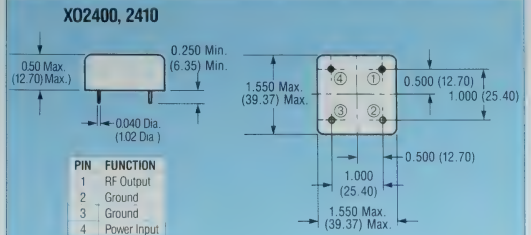




## SPECIFICATIONS

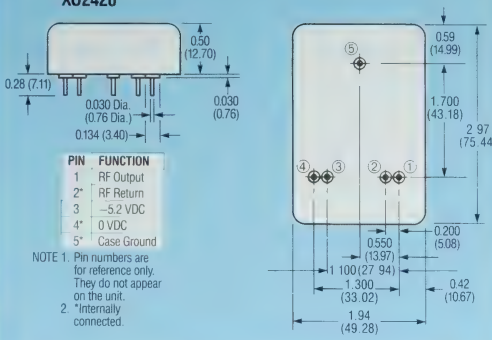
| MODEL | XO2400□□ | XO2410HE | XO2420HF |
|---|---|---|---|
| Features | Low Cost Basic Clock | Low Cost ECL Clock | High Frequency ECL Clock |
| Frequency Range | 1Hz to 100MHz | 20MHz to 200MHz | 50MHz to 700MHz |
| Input Voltage and Current | A Std. (+5VDC) @ 15mA Typ. | H Std. (–5.2VDC) @ 35mA Typ. | H Std. (–5.2VDC) @ 75mA Typ. |
| Output Type | T or H (TTL) ("HC" CMOS) | E Std. (10KH ECL) | F Std. (100K ECL) |
| Temperature Stability | ±50ppm –40°C to +85°C | ±50ppm –40°C to +85°C | ±50ppm 0°C to +85°C |

### XO2400, 2410




| PIN | FUNCTION |
|---|---|
| 1 | RF Output |
| 2 | Ground |
| 3 | Ground |
| 4 | Power Input |

### XO2420

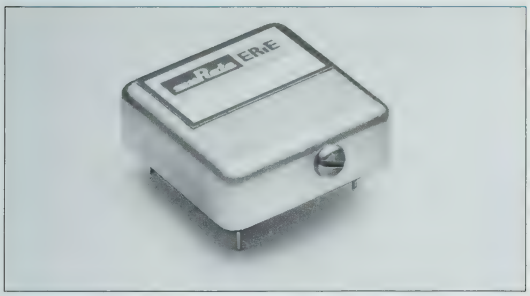



| PIN | FUNCTION |
|---|---|
| 1 | RF Output |
| 2* | RF Return |
| 3 | –5.2 VDC |
| 4* | 0 VDC |
| 5* | Case Ground |

NOTE 1. Pin numbers are for reference only. They do not appear on the unit.
2. *Internally connected.

Dimensions: in. (mm)

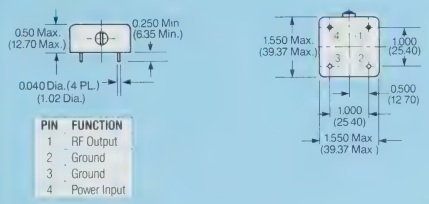
# SINE WAVE OSCILLATORS



## SPECIFICATIONS

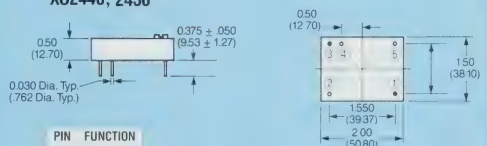
| MODEL | XO2430□□ | XO2440□□ | XO2450□□ | XO2460□□ |
|---|---|---|---|---|
| Features | Low Frequency Coverage Low Cost | Wide Frequency Range | VHF Range | UHF Range |
| Frequency Range | 1KHz to 10MHz | 5MHz to 150MHz | 150MHz to 500MHz | 300MHz to 1000MHz |
| Input Voltage and Current | A Std. (+5VDC) @ 15mA Typ. | E Std. (+15VDC) @ 40mA Typ. | E Std. (+15VDC) @ 50mA Typ. | E Std. (+15VDC) @ 75mA Typ. |
| Output Type | N Std. ($1V_{p-p}$, 1KΩ LOAD) | K Std. (+7dBm) | J Std. (+3dBm) | J Std. (+3dBm) |
| Temperature Stability | ±50ppm –40°C to +85°C | ±50ppm –40°C to +85°C | ±50ppm –40°C to +85°C | ±50ppm –40°C to +85°C |
| Package | 1.55×1.55×0.50 | 1.5×2.0×0.5 | 1.5×2.0×0.5 | 1.94×2.97×0.75 |

### XO2430



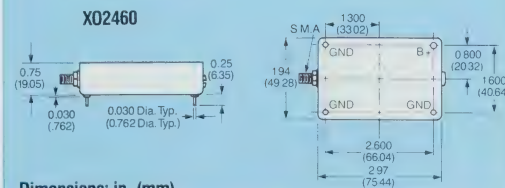

| PIN | FUNCTION |
|---|---|
| 1 | RF Output |
| 2 | Ground |
| 3 | Ground |
| 4 | Power Input |

### XO2440, 2450




| PIN | FUNCTION |
|---|---|
| 1 | B+ |
| 2 | Ground |
| 3 | Output |
| 4 | Ground |
| 5 | Ground |

### XO2460

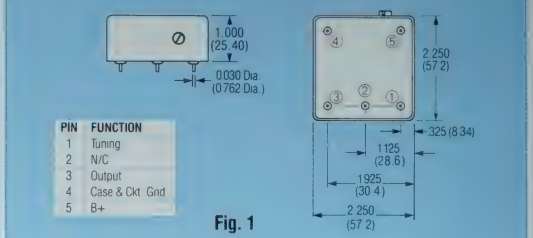



Dimensions: in. (mm)

## SPECIFICATIONS

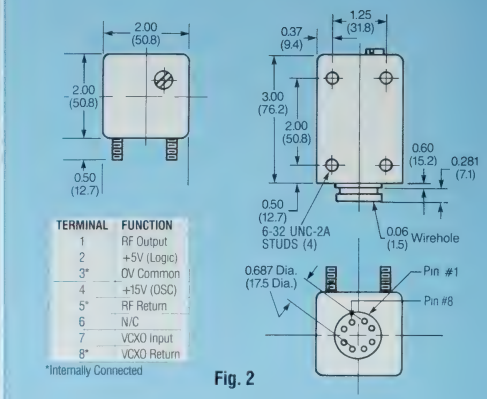
| MODEL | OC2500□□ | OC2510□□ | OC2520□□ |
|---|---|---|---|
| Features | Low Profile Oven | Standard Oven Package | "SC" or "IT" Cut Crystal For Fast Warm-Up Low Phase Noise |
| Frequency Range | 1MHz to 20MHz | 500KHz to 15MHz | 5MHz to 15MHz |
| Input Voltage and Power | E Std. (+15VDC) 1.5W @ 25°C Typ. 4W Max. @ Turn-On | E Std. (+15VDC) 1.7W @ 25°C Typ. 6W Max. @ Turn-On | E Std. (+15VDC) 3W @ 25°C Typ. 15W Max. @ Turn-On |
| Output Type | T Std. (TTL) | T Std. (TTL) | K Std. (+7dBm, Harmonics –30dBc) |
| Electronic Freq. Control and Freq. vs. Voltage Slope | ±2.0ppm min. for 0±5v Negative | ±1.0ppm min. for 0±5v Negative | $\pm 2\times10^{-7}$ min. for 0±5v Negative |
| Temperature Stability | $\pm 1\times10^{-7}$ –20°C to +70°C | $\pm 5\times10^{-8}$ –30°C to +70°C | $\pm 5\times10^{-9}$ –40°C to +75°C |
| Aging | $2\times10^{-9}$/DAY | $1\times10^{-9}$/DAY | $5\times10^{-10}$/DAY |
| Package | 2.25×2.25×1.00 | 2.0×2.0×3.0 | 2.0×2.0×4.0 |
| Figure | 1 | 2 | 3 |

| MODEL | OC2530□□ | OC2540□□ |
|---|---|---|
| Features | VHF Frequency Coverage | Miniature Pkg. Low Power Consumption |
| Frequency Range | 50MHz to 400MHz | 6MHz to 20MHz |
| Input Voltage and Power | E Std. (+15VDC) 3.0W @ 25°C Typ. 9W Max. @ Turn-On | C Std. (+10VDC) 0.3W @ 25°C Typ. 0.6W Max. @ Turn-On |
| Output Type | J Std. (+3 dBm) | T Std. (TTL) |
| Frequency Adjustment | ±3ppm Mechanical | ±5ppm Mechanical |
| Temperature Stability | $\pm 1\times10^{-7}$ –20°C to +70°C | $\pm 2\times10^{-7}$ –20°C to +50°C |
| Aging | $1\times10^{-8}$/DAY | $3\times10^{-9}$/DAY |
| Package | 2.0×2.0×4.0 | 1.55×1.55×0.75 |
| Figure | 3 | 4 |




| PIN | FUNCTION |
|---|---|
| 1 | Tuning |
| 2 | N/C |
| 3 | Output |
| 4 | Case & Ckt Gnd |
| 5 | B+ |

Fig. 1




| TERMINAL | FUNCTION |
|---|---|
| 1 | RF Output |
| 2 | +5V (Logic) |
| 3* | 0V Common |
| 4 | +15V (OSC) |
| 5* | RF Return |
| 6 | N/C |
| 7 | VCXO Input |
| 8* | VCXO Return |

*Internally Connected

Fig. 2

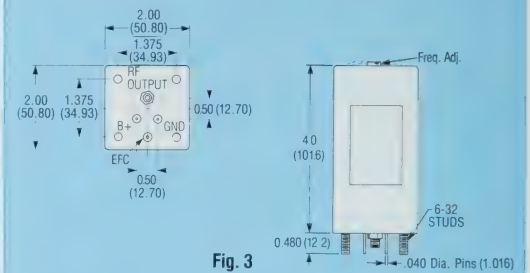
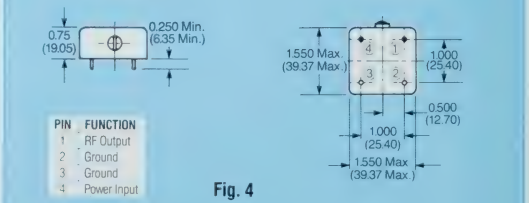


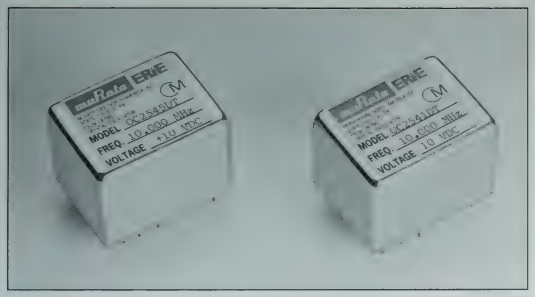

Fig. 3




| PIN | FUNCTION |
|---|---|
| 1 | RF Output |
| 2 | Ground |
| 3 | Ground |
| 4 | Power Input |

Fig. 4

Dimensions: in. (mm)



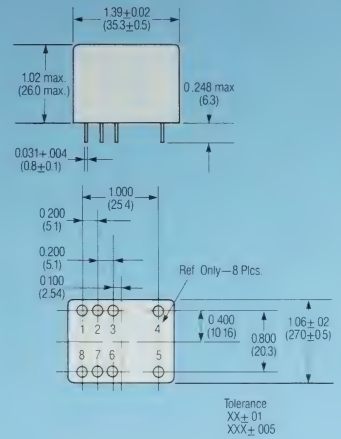
## SPECIFICATIONS

| MODEL | OC2545 DT |
|---|---|
| Features | Low cost<br>High stability<br>Low phase noise<br>Small package |
| Frequency Range | 5MHz to 20MHz |
| Input Voltage and Power | +12VDC @ 250 mA max. (90mA Typ.) |
| Output Type | TTL<br>50/50 duty cycle |
| Electronic Freq. Control: Freq. vs. Voltage | ±4ppm min.,<br>0 to +6VDC |
| Temperature Stability | ±0.05ppm Typ., 0°C to +50°C |
| Aging | 0.3ppm/Yr. |
| Package | 1.39" x 1.06" x 1.00" |

## SPECIFICATIONS

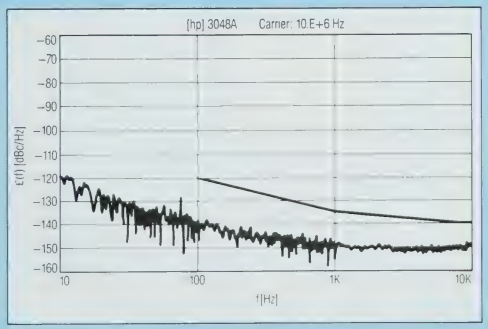
| MODEL | OC2541 DT |
|---|---|
| Features | Very low cost for<br>High stability "SC" cut osc.<br>Low phase noise<br>Small package |
| Frequency Range | 5MHz to 20MHz |
| Input Voltage and Power | +12VDC @ 250 mA max. (90mA Typ.) |
| Output Type | TTL<br>50/50 duty cycle |
| Electronic Freq. Control: Freq. vs. Voltage | ±1ppm min.,<br>0 to +10VDC |
| Temperature Stability | ±0.01ppm Typ., 0°C to +50°C |
| Aging | 0.15ppm/Yr. |
| Package | 1.39" x 1.06" x 1.00" |

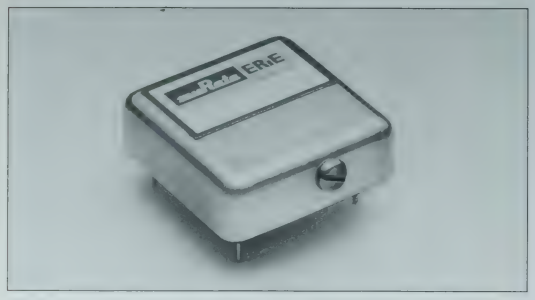
## OC2541, 2545




| PIN | FUNCTION |
|---|---|
| 1 | Output |
| 2 | N/C |
| 3 | N/C |
| 4 | Ground |
| 5 | N/C |
| 6 | Control Voltage |
| 7 | N/C |
| 8 | +12V |

## TYPICAL PHASE NOISE CHARACTERISTICS






## SPECIFICATIONS

| MODEL | TC2130□□ | TC2140□□ | TC2150□□ |
|---|---|---|---|
| Features | Low cost<br>Hermetic package | High stability<br>Very low aging | Small<br>Hermetic package |
| Frequency Range | 500KHz to 24MHz | 6MHz to 20MHz | 5MHz to 24MHz |
| Frequency Stability vs. Temperature Range | ±1ppm<br>–20°C to +70°C | ±0.25ppm<br>0°C to +50°C | ±1ppm<br>–40°C to +85°C |
| Input Voltage & Current | D Std. (+12VDC)<br>@ 15mA Max.<br>(A thru G avail., power may vary) | D Std. (+12VDC)<br>@ 15mA Max.<br>(C thru G avail.) | D Std. (+12VDC)<br>@ 15mA Max. |
| Output type | T Std. (TTL) | T Std. (TTL) | T Std. (TTL) |
| Aging Rate | 1ppm/Yr. | 0.2ppm/Yr. | 1ppm/Yr. |
| Frequency Adjustment | Mechanical<br>10 Yr. Range Minimum | Mechanical<br>10 Yr. Range Minimum | Mechanical<br>10 Yr. Range Minimum |
| Figure | 1 | 2 | 3 |

| PIN | FUNCTION |
|---|---|
| 1 | Output |
| 2 | B+ |
| 3 | Ground |
| 4 | N/C |
| 5 | Ground |

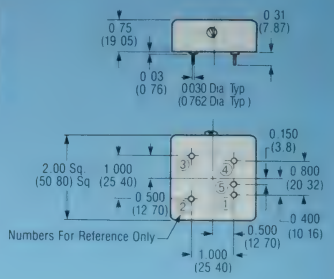



Fig. 1

| PIN | FUNCTION |
|---|---|
| 1 | Output |
| 2 | B+ |
| 3 | Ground |
| 4 | N/C |
| 5 | Ground |

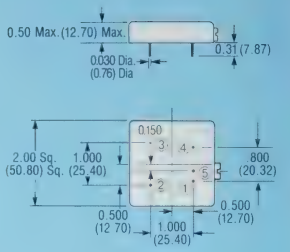



Fig. 2

| PIN | FUNCTION |
|---|---|
| 1 | RF Output |
| 2 | Ground |
| 3 | Ground |
| 4 | Power Input |

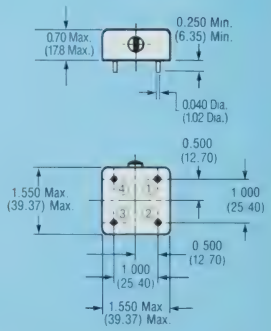
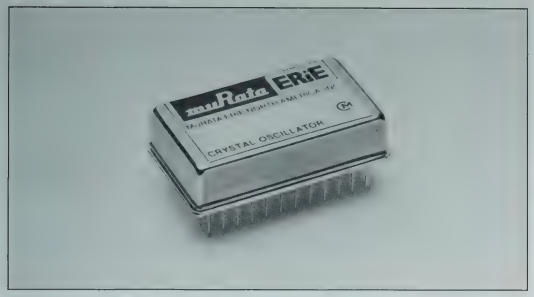



Fig. 3

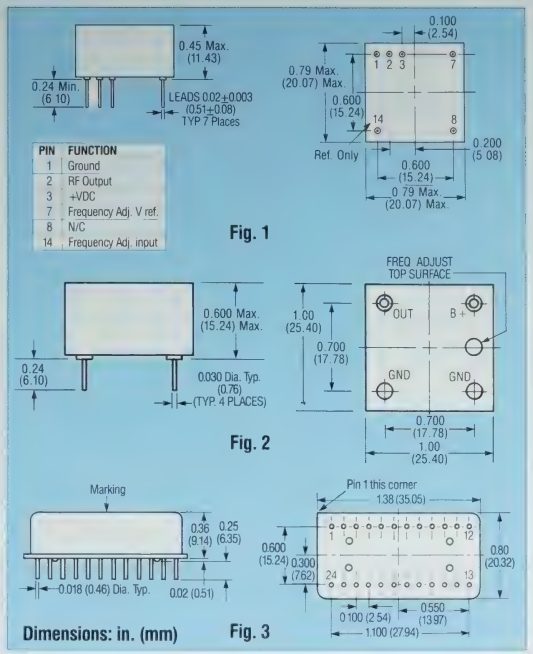
**Dimensions: in. (mm)**

# TCXO
# MINIATURE

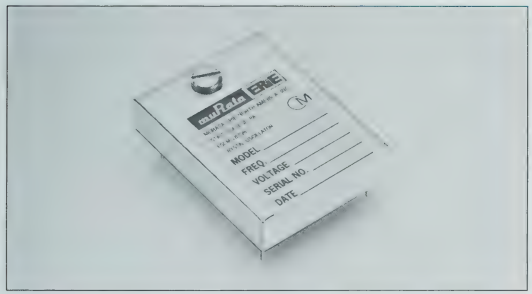



## SPECIFICATIONS

| MODEL | TC2100□□ | TC2110□□ | TC2120□□ |
|---|---|---|---|
| Features | Requires only 0.35 cu. in., Direct Replacement for K1516 Series | Low cost unit, +5VDC operation | Hermetically sealed, welded package for high Rel Applications |
| Frequency Range | 6MHz to 24MHz | 5MHz to 18MHz | 5MHz to 25MHz |
| Frequency Stability Vs. Temperature Range | ±2ppm, –40°C to +85°C | ±1ppm, –20°C to +70°C | ±1ppm, –40°C to +85°C |
| Input Voltage & Current | C Std. (+10VDC) @ 5mA Max. (B thru F available) | A Std. (+5VDC) @ 15mA Max. | D Std. (+12VDC) @ 10mA Max. |
| Output Type | N Std. (Harmonics < –20dBc) | H Std. | J Std. (Harmonics < –30dBc) |
| Aging Rate | 1ppm/YR | 1ppm/YR | 1ppm/YR |
| Frequency Adjustment | Electrical Via Ext. Pot. or control voltage; 5 Yr. Range Minimum | Mechanical 10 Yr. Range Minimum | Electrical Via Ext. Pot. or control voltage; 5 Yr. Range Minimum |
| Figure | 1 | 2 | 3 |

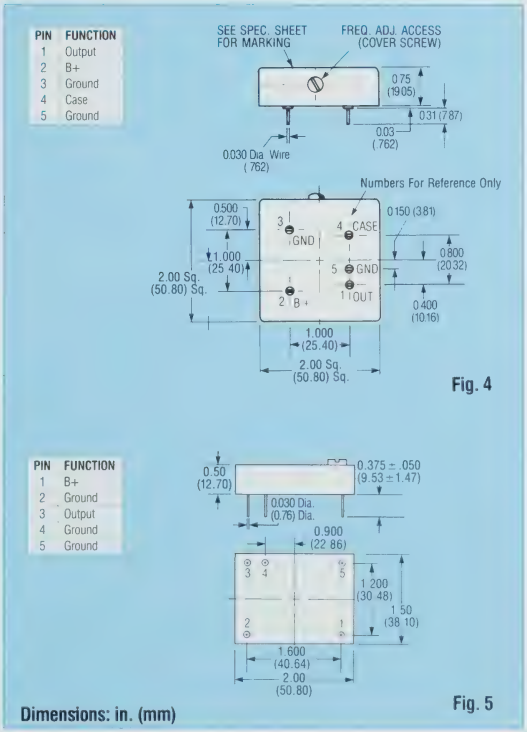



# TCXO
# HIGH FREQUENCY

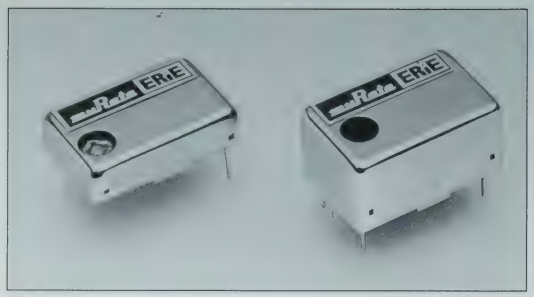



## SPECIFICATIONS

| MODEL | TC2160□□ | TC2170□□ | TC2180□□ |
|---|---|---|---|
| Features | Standard Hermetic Pkg.; Third overtone crystal eliminates sub-harmonics. | Small Package; Internal freq. multiplier for better stability with fundamental crystal. | Very small package for UHF TCXO |
| Frequency Range | 24MHz to 80MHz | 24MHz to 120MHz | 120MHz to 500MHz |
| Frequency Stability Vs. Temperature Range | ±2ppm, –20°C to +70°C | ±1ppm, –40°C to +70°C | ±5ppm, –40°C to +70°C |
| Input Voltage & Current | D Std. @ 25mA Max. (C thru G available) | B Std. @ 40mA Max. (B thru E available) | B Std. @ 45mA Max. (B thru E available) |
| Output Type | J Std. (+3dBm) (Harmonics < –30dBc) | J Std. (+3dBm) (Harmonics & Subharmonics < –30dBc) | J Std. (+3dBm) (Harmonics & Subharmonics < –30dBc) |
| Aging Rate | 2ppm/YR | 1ppm/YR | 2ppm/YR |
| Frequency Adjustment | Mechanical; 5 Yr. Range Minimum | Mechanical; 5 Yr. Range Minimum | Mechanical; 5 Yr. Range Minimum |
| Figure | 4 | 5 | 5 |



# TCXO
# LOW COST




## SPECIFICATIONS

| MODEL | TC301□□□ | TC3022□□ |
|---|---|---|
| Features | High stability | Low cost<br>Low power consumption |
| Frequency Range | Models TC3010, 3011:<br>5MHz to 16MHz<br>Model TC3012:<br>3.5MHz to 20.0MHz | 8MHz to<br>26 MHz |
| Frequency Stability<br>vs.<br>Temperature Range | Model TC3010:<br>±1ppm, −10°C to +60°C<br>Model TC3011:<br>±3ppm, −30°C to +80°C<br>Model TC3012:<br>±1ppm, −10°C to +50°C | ±3ppm,<br>0°C to +50°C |
| Input Voltage<br>& Current | D Std. (+12VDC) @ 20 mA | A Std. (+5VDC)<br>@ 3mA |
| Output Type | Models TC3010, 3011:<br>T Std. (TTL)<br>Model TC3012:<br>P Std. (0 dBm) | Q Std.<br>(1 Vp-p) |
| Aging Rate | 2ppm/Yr. | 2ppm/Yr. |
| Frequency<br>Adjustment | Mechanical;<br>4 Yr. Range Minimum | Mechanical;<br>4 Yr. Range Minimum |
| Figure | 1 | 2 |

| MODEL | TC302□□□ | TC302□□□ |
|---|---|---|
| Features | Low cost<br>Cellular TCXO<br>Low profile | Low cost<br>Low power consumption |
| Frequency Range | Model TC3024:<br>12.8 MHz, 15.36 MHz<br>Model TC3025:<br>8 MHz to 26 MHz | Models TC3028, TC3027:<br>12.8 MHz, 21.25 MHz |
| Frequency Stability<br>vs.<br>Temperature Range | Model TC3024, TC3025:<br>±2.5ppm,<br>−30°C to +70°C | Model TC3028, TC3027:<br>±3.5ppm,<br>−10°C to +50°C |
| Input Voltage<br>& Current | A Std. (+5VDC)<br>@ 2 mA (TC3024)<br>@ 3 mA (TC3025) | Model TC3028: L Std. (+4VDC)<br>@ 3 mA<br>Model TC3027: A Std. (+5VDC)<br>@ 3 mA |
| Output Type | Model TC3024, TC3025<br>R Std.<br>(1Vp-p) | Model TC3028, TC3027:<br>R Std.<br>(1Vp-p) |
| Aging Rate | 2ppm/Yr. | 2ppm/Yr. |
| Frequency<br>Adjustment | Mechanical;<br>4 Yr. Range Minimum | Mechanical;<br>4 Yr. Range Minimum |
| Figure | TC3024: 3<br>TC3025: 2 | 2 |

**Fig. 1**

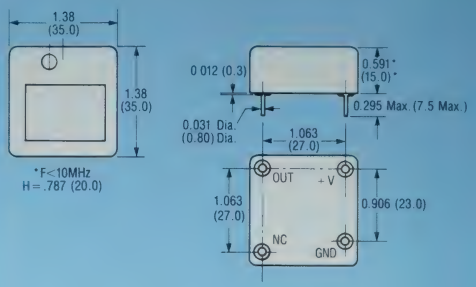
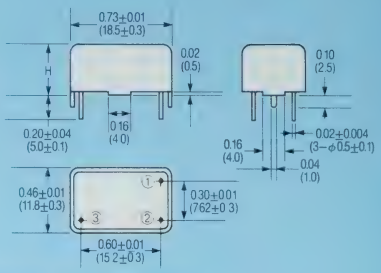


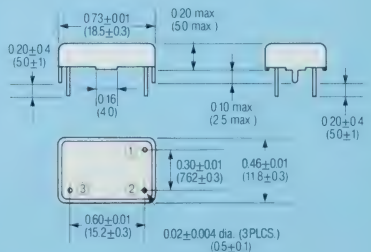

**Fig. 2**




| PIN | FUNCTION |
|---|---|
| 1 | Ground |
| 2 | Output |
| 3 | +DC |

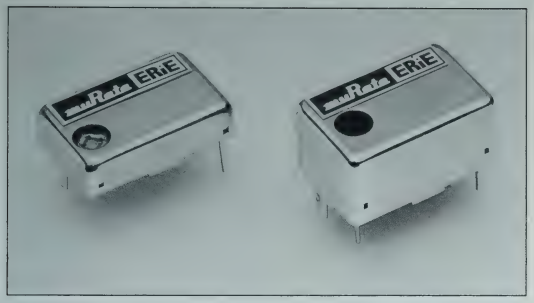
| P/N | Hmax |
|---|---|
| 3022 | 0.39 |
| 3025 | (10.0) |
| 3027 | 0.31 |
| 3028 | (8.0) |

**Fig. 3**




| PIN | FUNCTION |
|---|---|
| 1 | Ground |
| 2 | Output |
| 3 | +DC |

# TCXO
# LOW COST



## SPECIFICATIONS

| MODEL | TC3030□□ | TC3040□□ | TC3050□□ |
|---|---|---|---|
| Features | Low cost<br>Small package | High stability | High frequency<br>Small package |
| Frequency Range | 8MHz to 20MHz | 1MHz, 5MHz, 10MHz | 8MHz to 60MHz |
| Frequency Stability vs. Temperature Range | ±3ppm, −10°C to +60°C | ±1ppm, −10°C to +60°C | ±5ppm, 0°C to +50°C |
| Input Voltage & Current | A Std. (+5VDC)<br>@ 10mA | A Std. (+5VDC)<br>@ 30mA | A Std. (+5VDC)<br>@ 20mA |
| Output Type | T Std. (TTL) | T Std. | T Std. (TTL) |
| Aging Rate | 4ppm/Yr. | 2ppm/Yr. | 4ppm/Yr. |
| Frequency Adjustment | Mechanical;<br>3 Yr. Range Minimum | Mechanical;<br>4 Yr. Range Minimum | Not availabile |
| Figure | 1 | 3 | 2 |

**Fig. 1**

| PIN | FUNCTION |
|---|---|
| 1 | N/C |
| 7 | Ground |
| 8 | Output |
| 14 | +DC |

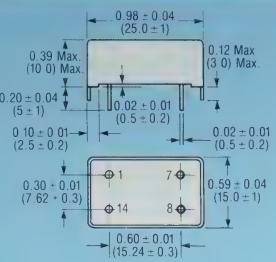



**Fig. 2**

| PIN | FUNCTION |
|---|---|
| 1 | N/C |
| 7 | Ground |
| 8 | Output |
| 14 | +V |

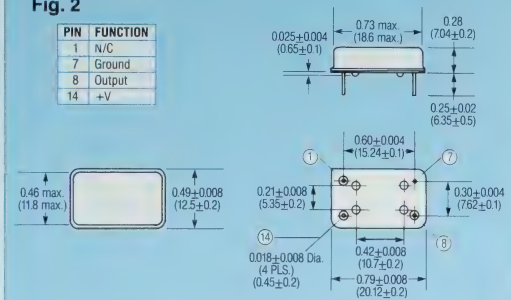
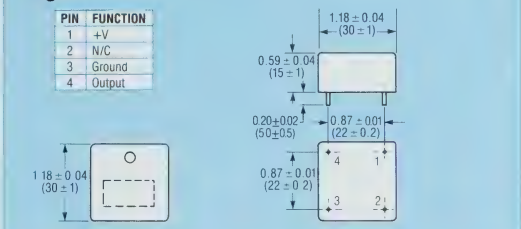



**Fig. 3**

| PIN | FUNCTION |
|---|---|
| 1 | +V |
| 2 | N/C |
| 3 | Ground |
| 4 | Output |

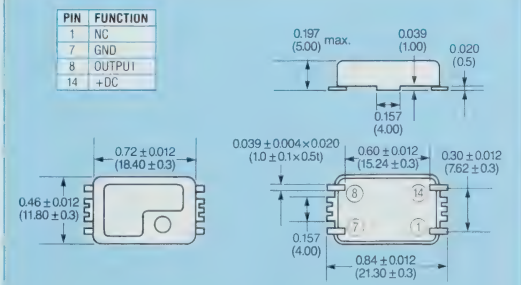



Dimensions: in. (mm)

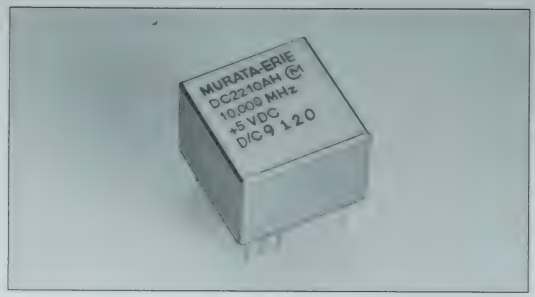
# TCXO
# SURFACE MOUNT–LOW COST

| MODEL | TCS3025AR |
|---|---|
| Output Frequency | 12.8 MHz, 15.36 MHz |
| Supply Voltage | +5.0 VDC, ±5% |
| Current | 2.0 mA max. |
| Output Level | 1 Vp-p min. (no bias) |
| Load | 20 KΩ // 10 pF |
| Frequency Stability<br>vs. Temperature<br>vs. Supply Voltage | ±2.5 ppm max. (−30 to +70°C)<br>±0.3 ppm max. (5.0V±5%) |
| Frequency Adjustment | ±3 ppm min. |
| Operating Temperature Range | −30°C to +80°C |
| Aging | ±1 ppm max./year |

| PIN | FUNCTION |
|---|---|
| 1 | NC |
| 7 | GND |
| 8 | OUTPUT |
| 14 | +DC |



# DCXO
# SINGLE CHIP



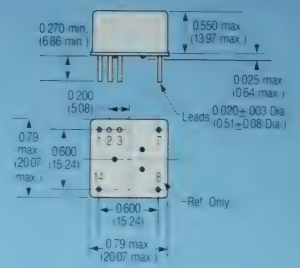

## SPECIFICATIONS – MODEL DC221□□□

- Only one active device gives high reliability
- Low parts count for smallest size and best price
- Better stability than any other low cost TCXO

Frequency Range: 6MHz to 25MHz
Output: "H" ("HC" CMOS)
Spurious: –60dBc Typ.
Input Voltage: A Std. (+5VDC)
Input Current: 20mA Typ.
Frequency Adjustment:
To offset at least 10 Yrs. Aging

Frequency Stability: (△f/f) vs.:
Temperature: See Table
Input Voltage: $\pm 1\times10^{-6}$/%
Load Variation: $\pm 1\times10^{-6}$/%
Time: 1ppm/Yr. Typ.
Time After Turn-On:
$\pm 1\times10^{-7}$ within 5 sec.
Short Term (T=1 sec.): $1\times10^{-9}$

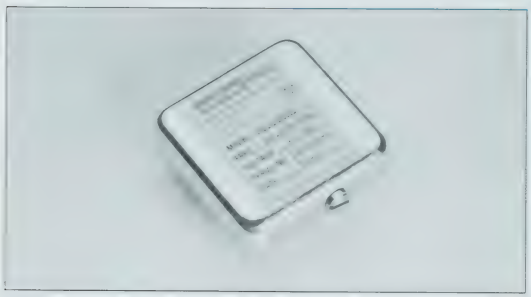
| MODEL NO. | Temp. Range | Max. Freq. Error |
|---|---|---|
| DC2210 | –40°C to +85°C | $\pm 1\times10^{-6}$ |
| DC2211 | –20°C to +75°C | $\pm 5\times10^{-7}$ |
| DC2212 | 0°C to +70°C | $\pm 3\times10^{-7}$ |
| DC2213 | 0°C to +50°C | $\pm 2\times10^{-7}$ |




| PIN | FUNCTION |
|---|---|
| 1 | Ground |
| 2 | RF Output |
| 3 | +VDC |
| 7 | Frequency Adj. V Ref. |
| 8 | N/C |
| 14 | Freq. Adj. Input |

Dimensions: in. (mm)

# DCXO
# HIGH STABILITY



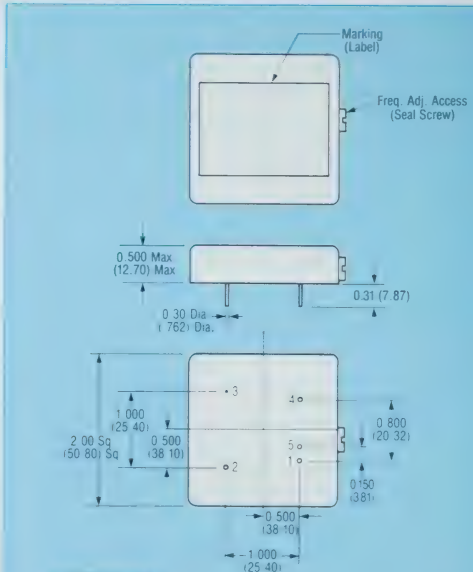
## SPECIFICATIONS – MODEL DC220□□□

- Single +5VDC supply, low power consumption
- High stability yet low cost – best price/performance ratio available
- Low profile package – 2.0×2.0×0.5″H

Frequency Range: 100KHz to 22MHz
Output: T Std. (TTL); C, J optional
Output Symmetry: 50/50 ±5%
Spurious: –60dBc Typ.
Input Voltage: A Std. (+5VDC)
Input Current: 18mA Typ.
Mechanical Frequency Adjustment:
To offset at least 5 Yrs. Aging

Frequency Stability: (△f/f) vs.:
Temperature: See Table
Input Voltage: $\pm 1\times10^{-6}$/%
Load Variation: $\pm 1\times10^{-6}$/%
Time: $\pm 5\times10^{-7}$/Yr. Typ.
Time After Turn-On:
$\pm 1\times10^{-7}$ within 5 sec.
Short Term (T=1 sec.): $1\times10^{-10}$

| MODEL NO. | Temp. Range | Max. Freq. Error |
|---|---|---|
| DC2200 | –40°C to +85°C | $\pm 2\times10^{-7}$ |
| DC2201 | –20°C to +75°C | $\pm 1\times10^{-7}$ |
| DC2202 | 0°C to +70°C | $\pm 7\times10^{-8}$ |
| DC2203 | 0°C to +50°C | $\pm 5\times10^{-8}$ |




| PIN | FUNCTION |
|---|---|
| 1 | Output |
| 2 | N/C |
| 3 | Ground |
| 4 | +5VDC |
| 5 | Ground |

Dimensions: in. (mm)

# VCXO
# MINIATURE HYBRID

## SPECIFICATIONS

| MODEL | VH2330□□ | | VH2340□□ | | VH235□□□ | | |
|---|---|---|---|---|---|---|---|
| Features | High frequency crystal | | High frequency crystal | | 24-pin package allows higher frequency operation | | |
| Frequency Range | 15MHz to 60MHz | | 15MHz to 60MHz | | 20MHz to 160MHz | | |
| Input Voltage & Current | A Std. (+5VDC) @ 20mA Typ. | | H Std. (−5.2VDC) @ 35mA Typ. | | H Std. (−5.2VDC) @ 60mA Max. | | |
| Output Type | H Std. ("HC" CMOS) | | E Std. (ECL "10kH") | | E Std. (ECL "10kH") | | |
| Control Voltage and Freq. vs. Voltage Slope | 0.5V to 4.5V Positive | | 0V to −5.0V Negative | | 0 ± 5.0V Positive | | |
| AFC Input Impedance | 10KΩ Min. | | 10KΩ Min. | | 10KΩ Min. | | |
| Linearity | ±20% | | ±20% | | ±20% | | |
| Model | Deviation | Temp. Stability | Deviation | Temp. Stability | Model | Deviation | Temp. Stability |
| | ±100ppm | ±25ppm | ±100ppm | ±25ppm | VH2350 | ±100ppm | ±25ppm |
| | | | | | VH2351 | ±250ppm | ±50ppm |
| | | | | | VH2352 | ±500ppm | ±100ppm |
| Temp. Range | 0°C to 70°C | | 0°C to 70°C | | 0°C to 70°C | | |
| Figure | 1 | | 1 | | 2 | | |

**VH2340**

| PIN | FUNCTION |
|---|---|
| 1 | Voltage Control Input |
| 7 | $V_{ee}$ (−5.2V) |
| 8 | Output |
| 14 | Case & Circuit Ground |

**VH2330**

| PIN | FUNCTION |
|---|---|
| 1 | Voltage Control Input |
| 7 | Case & Circuit Ground |
| 8 | Output |
| 14 | $V_{cc}$ |

**VH2350, 51, 52**

| PIN | FUNCTION |
|---|---|
| 1 | Voltage Control Input |
| 12 | $V_{ee}$ (−5.2V) |
| 13 | Output |
| 24 | Case & Circuit Ground |

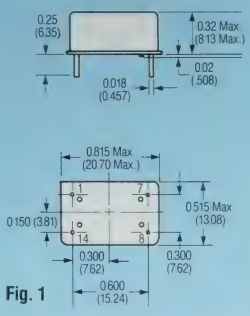



Fig. 1

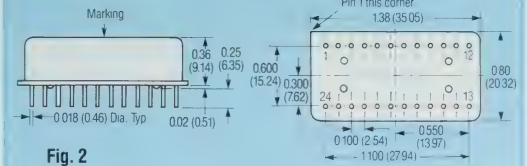



Fig. 2

Dimensions: in. (mm)

# VCXO
# STANDARD

## SPECIFICATIONS

| MODEL | VO230□□□ | | VO231□□□ | | | VO232□□□ | | |
|---|---|---|---|---|---|---|---|---|
| Features | Standard VCXO | | Wide deviation; Good linearity | | | High frequency VCXO | | |
| Frequency Range | 500KHz to 25MHz | | 1MHz to 25MHz | | | 25MHz to 125MHz | | |
| Input Voltage & Current | D Std. (+12VDC) @ 25mA Max. | | D Std. (+12VDC) @ 30mA Max. | | | D Std. (+12VDC) @ 50mA Max. | | |
| Output Type | H Std. ("HC" CMOS) | | H Std. ("HC" CMOS) | | | K Std. (+7 dBm) (Harmonics and Subharmonics < −20dBc) | | |
| Control Voltage and Freq. vs. Voltage Slope | 0 ± 5V Negative | | 0 ± 5V Negative | | | 0 ± 5V Negative | | |
| AFC Input Impedance | 10KΩ Nom. | | 10KΩ Nom. | | | 1KΩ Nom. | | |
| Linearity | ±10% | | ±2% | | | ±2% | | |
| Model | Deviation | Temp. Stability | Model | Deviation | Temp. Stability | Model | Deviation | Temp. Stability |
| VO2300 | ±100ppm | ±10ppm | VO2310 | ±250ppm | ±50ppm | VO2320 | ±100ppm | ±25ppm |
| VO2301 | ±200ppm | ±20ppm | VO2311 | ±500ppm | ±50ppm | VO2321 | ±250ppm | ±50ppm |
| VO2302 | ±300ppm | ±25ppm | VO2312 | ±1000ppm | ±100ppm | VO2322 | ±500ppm | ±50ppm |
| | | | | | | VO2323 | ±1000ppm | ±100ppm |
| Temp. Range | 0°C to 70°C | | 0°C to 70°C | | | 0°C to 70°C | | |
| Figure | 1 | | 2 | | | 3 | | |

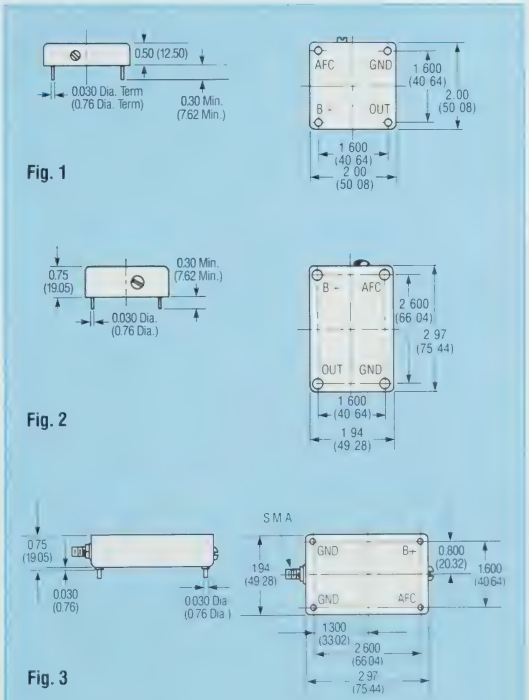


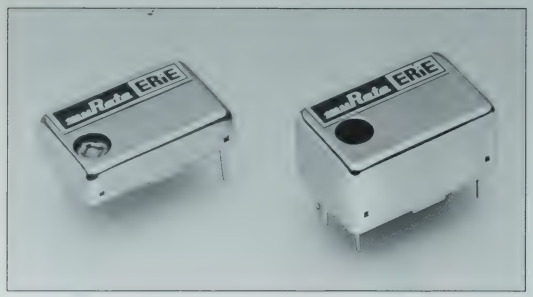

Fig. 1

Fig. 2

Fig. 3

Dimensions: in. (mm)

# VCXO
# LOW COST

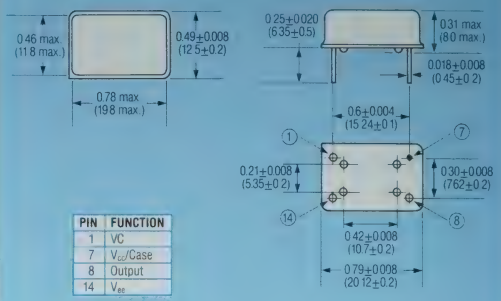


## SPECIFICATIONS

| MODEL | VO3110□□ | | | VO3120□□□ | | |
|---|---|---|---|---|---|---|
| Features | Low cost; Small package | | | Low cost; Low profile | | |
| Frequency Range | 8MHz to 36MHz | | | Model VO3120: 8MHz to 24MHz<br>Model VO3121: 8MHz to 36MHz | | |
| Input Voltage | A Std. (+5VDC) @ 15mA | | | Model VO3120: A Std. @ 20mA<br>Model VO3121: A Std. @ 30mA | | |
| Output Type | T Std. (TTL)<br>C optional (CMOS) | | | T Std. (TTL)<br>C optional (CMOS) | | |
| | Model | Deviation | Temp. Stability | Model | Deviation | Temp. Stability |
| | VO3110 | ±50ppm | ±20ppm | VO3120<br>VO3121 | ±50ppm<br>±200ppm | ±30ppm<br>±30ppm |
| Control Voltage | 2.5±2.5V | | | 2.5±2.5V | | |
| Aging Rate | 10ppm/Yr. | | | VO3120: 4ppm/Yr.<br>VO3121: 10ppm/Yr. | | |
| Temp. Range | –10°C to 60°C | | | –10°C to 60°C | | |

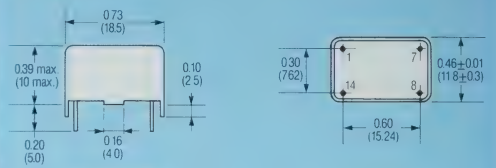
| MODEL | VO3130□□ | | VO3140□□ | | VO3150□□ | |
|---|---|---|---|---|---|---|
| Features | High frequency | | ECL | | High frequency | |
| Frequency Range | 36MHz to 80MHz | | 40MHz to 100MHz | | 80MHz to 200MHz | |
| Input Voltage & Current | A Std. (+5VDC) @ 60 mA | | H Std. (–5.2VDC) @ 40 mA | | H Std. (–5.2VDC) @ 100 mA | |
| Output Type | T Std.; C optional | | E Std. (ECL "10KH") | | E Std. (ECL "10KH") | |
| | Deviation | Temp. Stability | Deviation | Temp. Stability | Deviation | Temp. Stability |
| | ±50ppm | ±15ppm | ±50ppm | ±15ppm | ±30ppm | ±10ppm |
| Control Voltage | 2.5±2.5V | | 2.5±2.5V | | 0±2V | |
| Aging Rate | 10ppm/Yr. | | 6ppm/Yr. | | 4ppm/Yr. | |
| Temp. Range | 0°C to 70°C | | 0°C to +70°C | | 0°C to +70°C | |

### VO3140



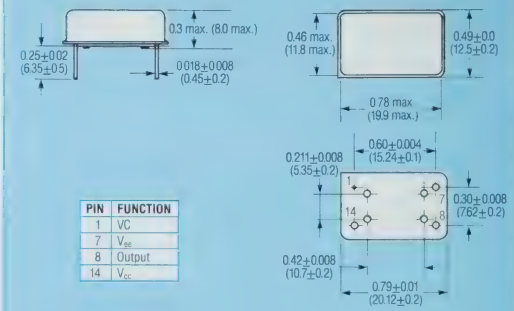

| PIN | FUNCTION |
|---|---|
| 1 | VC |
| 7 | $V_{EE}$/Case |
| 8 | Output |
| 14 | $V_{ee}$ |

### VO3110



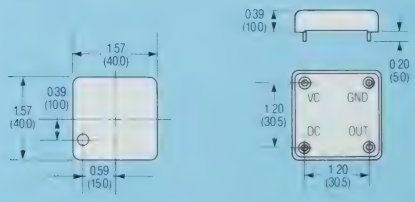

| PIN | FUNCTION |
|---|---|
| 1 | VC |
| 7 | Ground |
| 8 | Output |
| 14 | +DC |

### VO3120, 3121, 3130



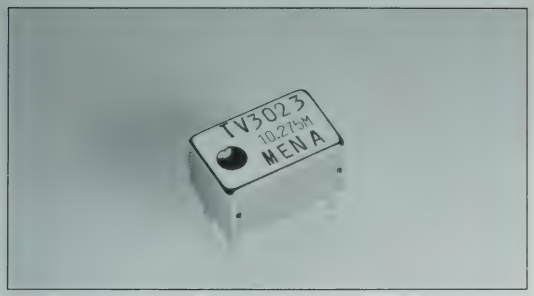

| PIN | FUNCTION |
|---|---|
| 1 | VC |
| 7 | $V_{ee}$ |
| 8 | Output |
| 14 | $V_{cc}$ |

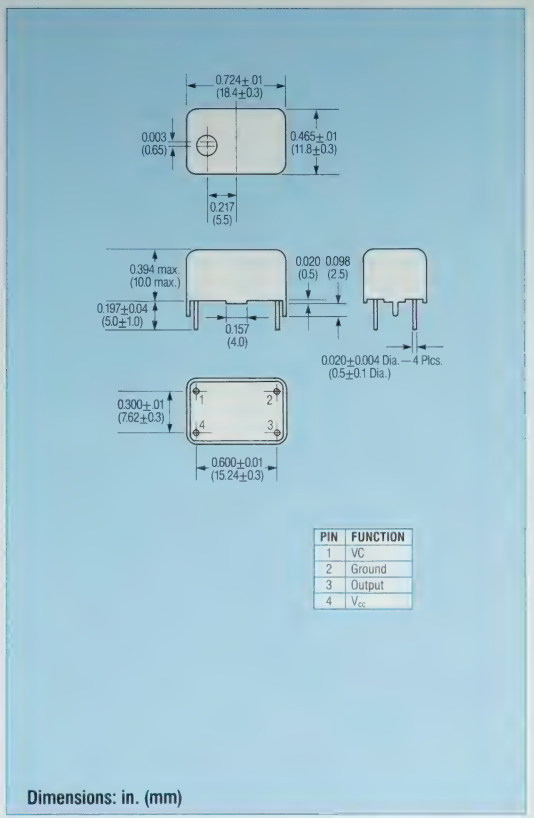
### VO3150




Dimensions: in. (mm)

# TCVCXO
# LOW COST




| PIN | FUNCTION |
|---|---|
| 1 | VC |
| 2 | Ground |
| 3 | Output |
| 4 | $V_{cc}$ |

Dimensions: in. (mm)

## SPECIFICATIONS

| MODEL | | TV3023 AR |
|---|---|---|
| Features | | Low cost |
| Frequency Range | | 9.6MHz to 26.0MHz |
| Input Voltage and Current | | A Std. (+5.0VDC) @ 2mA max. |
| Output Type | | R Std. (Clipped Sinewave 1Vp-p min.) |
| Load | | 20KΩ // 10pF |
| Frequency Adj. | | ±3ppm min. by inside trimmer |
| Electronic Freq. Control: Control Voltage and Deviation | | 2.5V ±2V, ±6.0 to ±12.0ppm |
| Frequency Stability | vs. Temperature | ±2.5ppm, −20°C to +70°C |
| | vs. Supply Voltage | ±0.3ppm (+5.0VDC ±5%) |
| Aging | | ±1.0ppm/Yr. Max. |
| Package | | 0.724" X 0.465" X 0.394" |

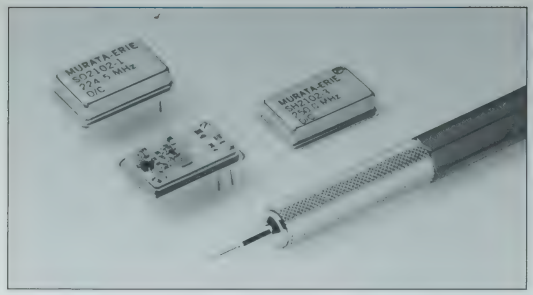
# TEMPERATURE COMPENSATED VOLTAGE CONTROLLED CRYSTAL OSCILLATORS— TCVCXO

For applications, such as phase locked loops (PLL), that require a highly stable output and an electrical frequency adjust use a TCVCXO. For large VCXO deviation, the temperature stability will be determined by the deviation range. Please consult factory for additional information.

## TYPICAL TCVCXO SPECIFICATIONS

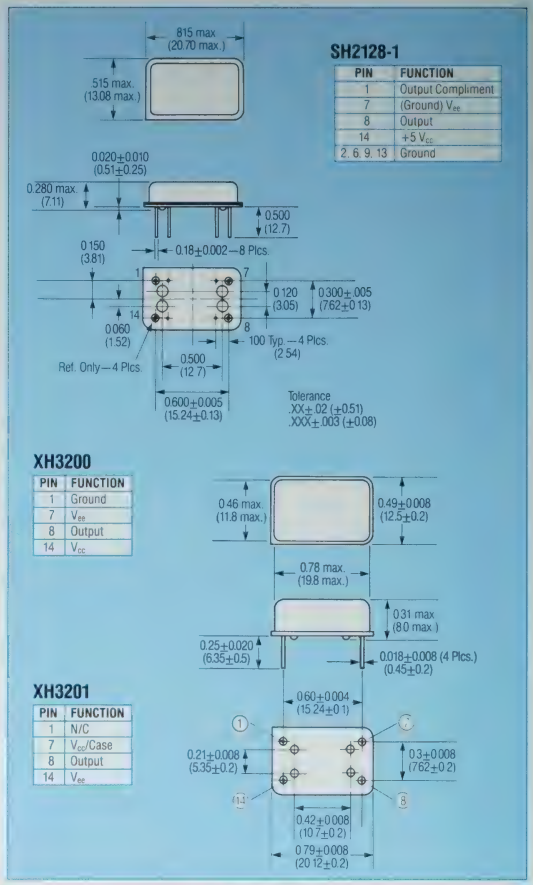
| Deviation | Temp. Stability | Temp. Range |
|---|---|---|
| +50ppm | ±1ppm | 0°C to 50°C |
| | ±2ppm | −40°C to +75°C |
| ±100ppm | ±2ppm | 0°C to +50°C |
| | ±4ppm | −40°C to 75°C |
| ±200ppm | ±2ppm | 0°C to 50°C |

# HIGH FREQUENCY CLOCK OSCILLATORS



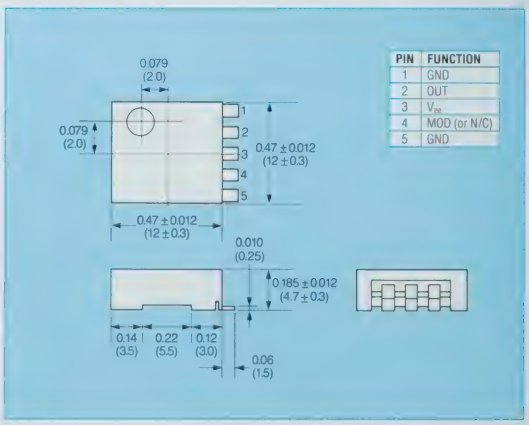

## SPECIFICATIONS

| MODEL | SH2128□□-1 | XH320□□□ |
|---|---|---|
| Features | Saw oscillator<br>High frequency<br>Small package<br>High performance | Small package<br>ECL clock |
| Frequency Range | 200MHz to 500MHz | 60MHz to 200MHz |
| Frequency Stability vs. Temperature Range | ±250ppm max.,<br>0°C to +70°C | ±100ppm,<br>0°C to +70°C |
| Input Voltage & Current | A Std. (+5VDC)<br>@ 120mA max.<br>(H optional (−5.2VDC)) | Model XH3200, XH3201<br>H Std. (−5.2VDC)<br>@ 60mA max. |
| Output Type | F Std. (ECL "100K") | E Std. (ECL "10KH") |
| Duty Cycle | 50/50±10% | 50/50±10% |
| Rise & Fall Times | 1.0nS max. | 2nS max. |
| Load | 50 OHMs to −2V | 50 OHMs to −2V |
| Aging Rate | ±5ppm/Yr. typ. | 4ppm/Yr. |
| Storage Temperature Range | −20°C to +80°C | −40°C to +85°C |



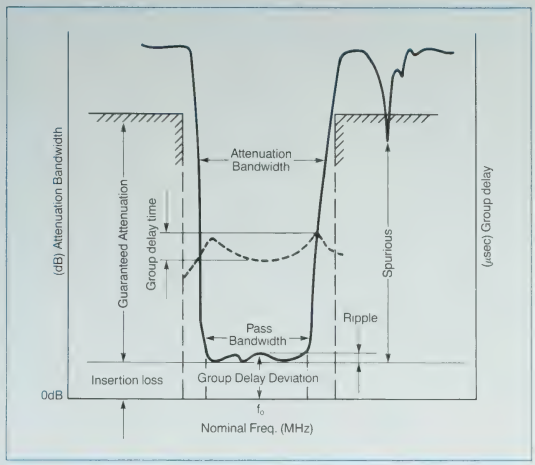

# TCVCXO
# SURFACE MOUNT–LOW COST

| MODEL | TVS3023AQ |
|---|---|
| Output Frequency | 12.800 MHz, 15.360 MHz |
| Supply Voltage | +5.0 VDC, ±5% |
| Current | 2mA max. |
| Output Level | 1 Vp-p min. Clipped Sinewave (DC cut) |
| Load | 10 KΩ / / 10 pF |
| Frequency Stability<br>vs. Temperature<br>vs. Supply Voltage<br>vs. Load<br>vs. Aging | <br>±2.5 ppm max. (−20°C to +70°C)<br>±0.3 ppm max. (+5.0V ±5%)<br>±0.2 ppm max. (10 KΩ / / 10 pF ±10%)<br>±1.0 ppm max. / year |
| Frequency Adjustment | ±3.0 ppm min. (by trimmer inside) |
| Frequency Control Range | ±6.0 ppm to ±12.0 ppm |
| Frequency Control Voltage | 2.5 V, ± 2.0 V |
| Operating Temperature Range | −20°C to +70°C |
| Storage Temperature Range | −30°C to +85°C |



Murata Erie Crystal Filters cover the frequency range from several MHz to 150MHz. Our thin wafer technology, as applied to these filters, results in highly reliable devices particularly suited to mobile communications applications.

## TYPICAL PERFORMANCE CURVE

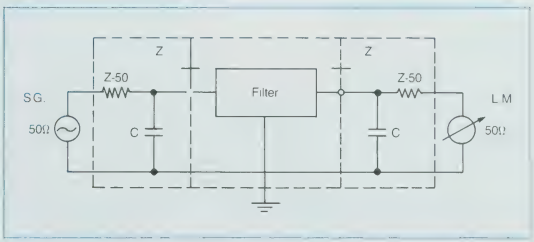



## TERMS

| | |
|---|---|
| **Nominal Frequency** | Nominal value of center frequency. |
| **Pass Bandwidth** | Width between frequencies which have same relative attenuation within the pass band. |
| **Attenuation Bandwidth** | Width between frequencies which have same relative attenuation within the attenuation band. |
| **Guaranteed Attenuation** | Guaranteed relative attenuation within the range of a certain frequency. |
| **Spurious Response** | Degraded attenuation caused by spurious response in the guaranteed attenuation band. |
| **Ripple** | Difference between maximum and minimum attenuation within pass band. |
| **Insertion Loss** | Difference of attenuation between filter input and output. |
| **Group Delay Deviation** | Difference between the maximum and the minimum values of the group delay within the pass band. |
| **Terminating Impedance** | Equivalent impedance on input and load side of filter shown with resistance component and parallel capacitance component including stray capacitance. |

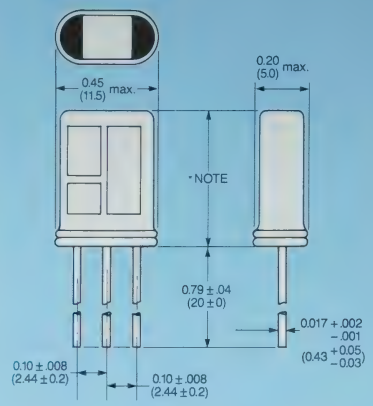
## TYPICAL MEASURING CIRCUIT

The measuring circuit for filters is shown with the resistance component and parallel capacitance component including stray capacitance. The terminating impedance is the outside circuit impedance to be connected to the filter. When the terminating impedance deviates from the specified value, it may be impossible to obtain the correct characteristics of the filter due to the large deviation of pass bandwidth, ripple and insertion loss. Therefore, it is important to match the outside circuit impedance. Shielding between input and output to prevent coupling is also important.



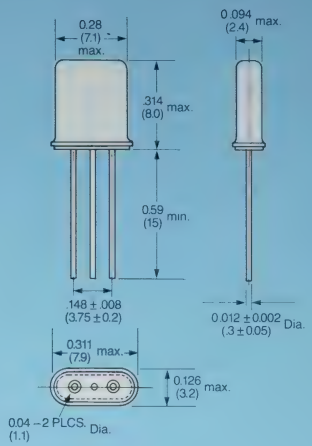
## DIMENSIONS: mm

### CASE: TR-49 (3 terminals)
### (Resistance weld type)

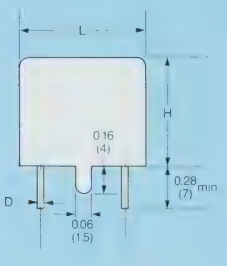


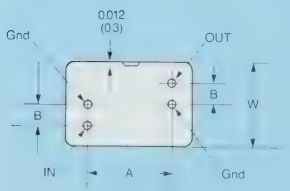

*NOTE: TR-49 (3) 0.53 (13.5) max.
TR-11 (3) 0.44 (11.2) max.

### CASE: TR-1 (3 terminals)
### (Resistance weld type)




### CASE: M TYPE




| Type | L | W | H | A | B | D |
|---|---|---|---|---|---|---|
| M-1 | 11.0 | 8.5 | 11.5 | 7.4 | 2.0 | 0.3 |
| M-2 | 13.4 | 8.5 | 11.5 | 9.8 | 2.0 | 0.3 |
| M-3 | 15 | 12 | 15 | 9.0 | 2.5 | 0.43 |
| M-4 | 18.5 | 12 | 15 | 13.4 | 2.5 | 0.43 |
| M-5 | 23 | 12 | 15 | 17.8 | 2.5 | 0.43 |
| M-6 | 28 | 12 | 15 | 22.2 | 2.5 | 0.43 |

Dimensions: mm

murata ERIE

# 10.7 and 21.4MHz

## 21.4MHz

| Model | Nominal Freq. | Pass Bandwidth | | Attenuation Bandwidth | | | | Ripple | Insertion Loss | Spurious Response | Terminating Impedance | Elements | Case |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | dB | ±KHz | dB | ±KHz | dB | ±KHz | dB Max. | dB Max. | dB Min. | (Ω / / pF) | | |
| **12.5KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF21M | 21.400 | 3 | 3.75 | 20 | 18 | | | 0.5 | 1.5 | 15 | 850 / / 6 | 1 | TR-1(3) |
| XF21MB | 21.400 | 3 | 3.75 | 40 | 14 | | | 1.0 | 2.0 | 40 | 850 / / 5 | 2 | TR-1(3)×2 |
| XF21MC | 21.400 | 3 | 3.75 | 45 | 8.75 | 65 | 12.5 | 2.0 | 3.0 | 65 | 850 / / 5 | 3 | M-1 |
| XF21MD | 21.400 | 3 | 3.75 | 65 | 8.75 | 85 | 12.5 | 2.0 | 4.0 | 90 | 850 / / 5 | 4 | M-1, M-2 |
| XF21ME | 21.400 | 6 | 3.75 | 75 | 8.75 | 90 | 9.5 | 2.0 | 5.0 | 90 | 850 / / 5 | 5 | M-2 |
| **20KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF21Q | 21.400 | 3 | 6.0 | 20 | 25 | | | 0.5 | 1.5 | 15 | 1200 / / 3.0 | 1 | TR-1(3) |
| XF21QB | 21.400 | 3 | 6.0 | 40 | 20 | | | 1.0 | 2.0 | 40 | 1200 / / 2.5 | 2 | TR-1(3)X2 |
| XF21QC | 21.400 | 3 | 6.0 | 45 | 15 | 20 | 20 | 2.0 | 2.5 | 65 | 1200 / / 2.5 | 3 | M-1 |
| XF21QD | 21.400 | 3 | 6.0 | 65 | 14 | 20 | 20 | 2.0 | 3.0 | 90 | 1200 / / 2.5 | 4 | M-1, M-2 |
| XF21QE | 21.400 | 6 | 6.0 | 75 | 14 | 16 | 16 | 2.0 | 4.0 | 90 | 1200 / / 2.5 | 5 | M-2 |
| **25KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF21R | 21.400 | 3 | 7.5 | 18 | 28 | | | 0.5 | 1.5 | 15 | 1500 / / 2.5 | 1 | TR-1(3) |
| XF21RB | 21.400 | 3 | 7.5 | 40 | 25 | | | 1.0 | 2.0 | 40 | 1500 / / 2.0 | 2 | TR-1(3)X2 |
| XF21RC | 21.400 | 3 | 7.5 | 45 | 17.5 | 65 | 25 | 2.0 | 2.5 | 65 | 1500 / / 2.0 | 3 | M-1 |
| XF21RD | 21.400 | 3 | 7.5 | 65 | 17.5 | 85 | 25 | 2.0 | 3.0 | 90 | 1500 / / 3.0 | 4 | M-1, M-2 |
| XF21RE | 21.400 | 6 | 7.5 | 75 | 16 | 90 | 18 | 2.0 | 4.0 | 90 | 1500 / / 2.0 | 5 | M-2 |

## 10.7MHz

| Model | Nominal Freq. | Pass Bandwidth | | Attenuation Bandwidth | | | | Ripple | Insertion Loss | Spurious Response | Terminating Impedance | Elements | Case |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | dB | ±KHz | dB | ±KHz | dB | ±KHz | dB Max. | dB Max. | dB Min. | (Ω / / pF) | | |
| **12.5KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF10M | 10.700 | 3 | 3.75 | 20 | 20 | | | 0.5 | 2 | | 1500 / / 7 | 1 | TR-49(3), TR-11(3) |
| XF10MB | 10.700 | 3 | 3.75 | 40 | 12.5 | | | 1 | 2.5 | 70 | 1500 / / 4 | 2 | TR-49(3)X2 |
| XF10MC | 10.700 | 3 | 3.75 | 45 | 8.75 | 65 | 12.5 | 2 | 3 | 90 | 1500 / / 4 | 3 | M-3 |
| XF10MD | 10.700 | 3 | 3.75 | 65 | 8.75 | 85 | 12.5 | 2 | 4 | 90 | 1500 / / 4 | 4 | M-4 |
| XF10ME | 10.700 | 6 | 3.75 | 75 | 8.75 | 90 | 9.5 | 2 | 5 | 90 | 1500 / / 4 | 5 | M-5 |
| **20KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF10Q | 10.700 | 3 | 6.0 | 20 | 25 | | | 0.5 | 2 | 15 | 2500 / / 3 | 1 | TR-49(3), TR-11(3) |
| XF10QB | 10.700 | 3 | 6.0 | 40 | 20 | | | 1 | 2.5 | 40 | 2500 / / 1.5 | 2 | TR-49(3)X2 |
| XF10QC | 10.700 | 3 | 6.0 | 45 | 14 | 65 | 20 | 2 | 3 | 65 | 2500 / / 1.5 | 3 | M-3 |
| XF10QC | 10.700 | 3 | 6.0 | 65 | 14 | 85 | 20 | 2 | 4 | 90 | 2500 / / 1.5 | 4 | M-4 |
| XF10QE | 10.700 | 6 | 6.0 | 75 | 14 | 90 | 16 | 2 | 5 | 90 | 2500 / / 1.5 | 5 | M-5 |
| **25KHz Bandwidth Series** | | | | | | | | | | | | | |
| XF10R | 10.700 | 3 | 7.5 | 18 | 25 | | | 0.5 | 2 | 15 | 3000 / / 2 | 1 | TR-49(3), TR-11(3) |
| XF10RB | 10.700 | 3 | 7.5 | 40 | 25 | | | 1 | 2.5 | 40 | 3000 / / 1 | 2 | TR-49(3)X2 |
| XF10RC | 10.700 | 3 | 7.5 | 45 | 17.5 | 65 | 25 | 2 | 3 | 65 | 3000 / / 1 | 3 | M-3 |
| XF10RD | 10.700 | 3 | 7.5 | 65 | 17.5 | 85 | 25 | 2 | 4 | 90 | 3000 / / 1 | 4 | M-4 |
| XF10RE | 10.700 | 6 | 7.5 | 75 | 16 | 90 | 18 | 2 | 5 | 90 | 3000 / / 1 | 5 | M-5 |

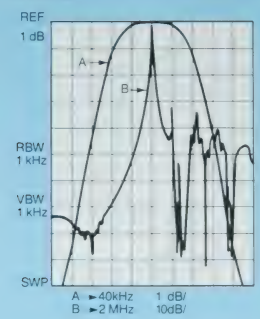
# Fundamental Mode 45 to 58MHz

## SPECIFICATIONS

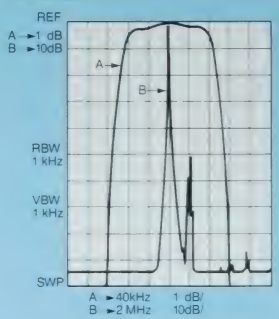
| Model | Nominal Freq. | Pass Bandwidth | | Attenuation Bandwidth | | Ripple | Loss | Guaranteed Attenuation | Impedance | Element | Case |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dB) | (KHz) | (dB) | (KHz) | (dB) | (dB) | (dB) | (Ω / / pF) | | |
| XF45R2 | 45.000 | 3 | ±7.5 | 24 | ±50 | 0 5 | 1.5 | 60 | 560 / / 6.0 | 1 | TR-1(3) |
| XF45RB2 | 45.000 | 3 | ±7.5 | 30 | ±25 | 1 | 3 | 80 | 560 / / 2.5 | 2 | TR-1(3)X2 |
| XF45U2 | 45.000 | 3 | ±15 | 20 | ±60 | 0.5 | 1.5 | 60 | 960 / / 2.0 | 1 | TR-1(3) |
| XF45UB2 | 45.000 | 1 | ±10 | 60 | ±100 | 1 | 3 | 80 | 1000 / / 1.2 | 2 | TR-1(3) |
| XF55NB | 55.025 | 3 | ±4.5 | 40 | ±25 | 1 | 5 | 80 | 220 / / 7.5 | 2 | TR-1(3)X2 |
| XF58RB2 | 58.1125 | 3 | ±8.5 | 25 | ±25 | 1 | 4 | 80 | 380 / / 3.5 | 2 | TR-1(3) |

## TYPICAL PERFORMANCE CHARACTERISTICS

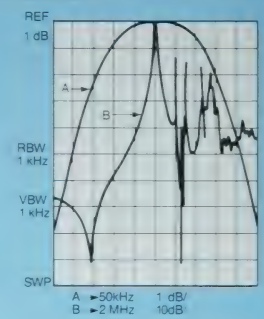
XF45R2



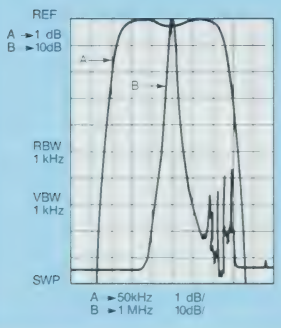

XF45RB2



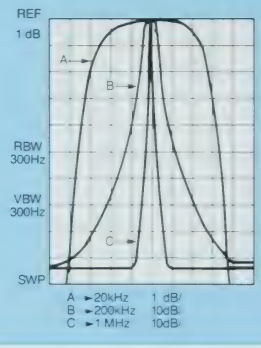

XF45U2



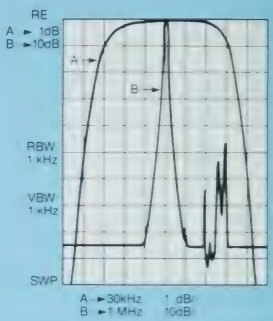

XF45UB2



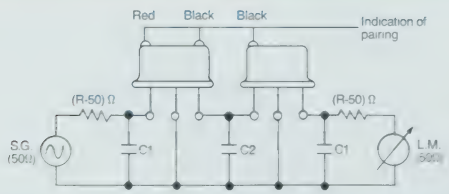

XF55NB




XF58RB2




## TEST CIRCUIT




| Model | R(Ω) | $C_1$(pF) | $C_2$(pF) |
|---|---|---|---|
| XF45R2 | 560 | 6.0 | — |
| XF45RB2 | 560 | 2.5 | 12.0 |
| XF45U2 | 960 | 2.0 | — |
| XF45UB2 | 1000 | 1.2 | 7.0 |
| XF55NB | 220 | 7.5 | 28.0 |
| XF58RB2 | 380 | 3.5 | 14.0 |

# CRYSTAL FILTERS
# VHF

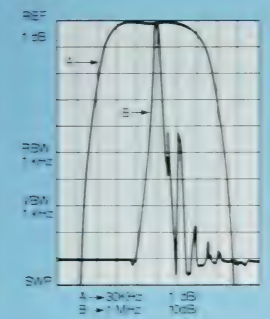
49 to 95MHz

## SPECIFICATIONS

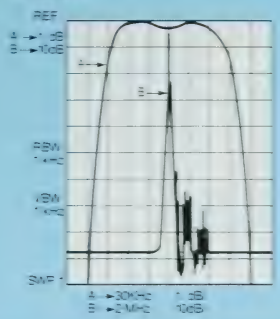
| Model | Nominal Freq. | Pass Bandwidth | | Attenuation Bandwidth | | Ripple | Loss | Guaranteed Attenuation | Impedance | Element | Case |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dB) | (KHz) | (dB) | (KHz) | (dB) | (dB) | (dB) | (Ω / / pF) | | |
| XF49Q2 | 49.000 | 3 | ±5 | 30 | ±45 | 1 | 2 | 35 | 3.3KΩ / / −1.0pF | 1 | TR-1(3) |
| XF55RB | 55.025 | 3 | ±8.5 | 25 | ±25 | 1 | 3 | 80 | 3.9KΩ / / −1.0pF | 2 | TR-1(3)X2 |
| XF58RB | 58.1125 | 3 | ±8.5 | 25 | ±25 | 1 | 3 | 80 | 3.0KΩ / / −1.0pF | 2 | TR-1(3)×2 |
| XF70QB | 70.000 | 3 | ±6 | 30 | ±20 | 1 | 3.5 | 75 | 1.8KΩ / / −0.3pF | 2 | TR-1(3)X2 |
| XF70RB3 | 70.000 | 3 | ±7.5 | 40 | ±30 | 1 | 3 | 75 | 2.0KΩ / / −0.5pF | 2 | TR-1(3)X2 |
| XF70UB | 70.000 | 3 | ±13 | 60 | ±100 | 1 | 3 | 80 | 3.9KΩ / / −1.0pF | 2 | TR-1(3)X2 |
| XF86RB | 86.000 | 3 | ±7.5 | 40 | ±30 | 1 | 3 | 80 | 3.0KΩ / / −1.0pF | 2 | TR-1(3)X2 |
| XF90UB | 90.000 | 3 | ±13 | 60 | ±100 | 1 | 3 | 80 | 3.3KΩ / / −1.0pF | 2 | TR-1(3)X2 |
| XF95UB2 | 96.000 | 1 | ±10 | 30 | ±60 | 1 | 4 | 75 | 3.0KΩ / / −1.0pF | 2 | TR-1(3)X2 |

## TYPICAL PERFORMANCE

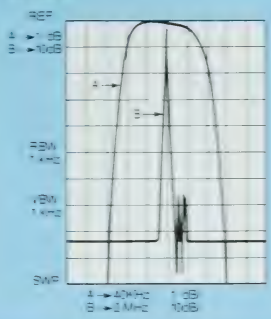
XF58RB



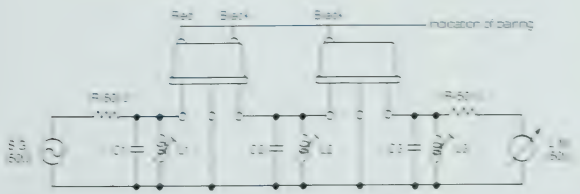

XF70RB3




XF86RB




## TEST CIRCUIT




| Model | R(Ω) | C1.2.3(pF) |
|---|---|---|
| XF49Q2 | 3300 | 5.0 |
| XF55RB | 3900 | 4.0 |
| XF58RB | 3000 | 4.0 |
| XF70QB | 1800 | 3.0 |
| XF70RB3 | 2000 | 3.0 |
| XF70UB | 3900 | 3.0 |
| XF86RB | 3000 | 2.5 |
| XF90UB | 3300 | 2.5 |
| XF95UB2 | 3000 | 2.5 |

# CRYSTAL FILTERS
# VHF WITH MATCHING TRANSFORMER

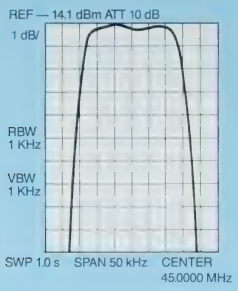
## 45 to 95MHz

### SPECIFICATIONS

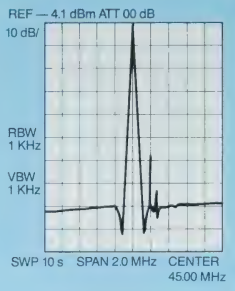
| Model | Nominal Freq. (MHz) | Pass Bandwidth (dB) | Pass Bandwidth (KHz) | Attenuation Bandwidth (dB) | Attenuation Bandwidth (KHz) | Ripple (dB Max.) | Loss (dB Max.) | Spurious Response (dB Min.) | Terminating Impedance (Ω) |
|---|---|---|---|---|---|---|---|---|---|
| **XF45UB5** | 45.000 | 3 | ±13 | 40 | ±50 | 1 | 4 | 40 | 50 |
| **XF55NB2** | 55.025 | 3 | ±4.5 | 40 | ±25 | 1 | 5 | 40 | 50 |
| **XF77RB** | 77.2500 | 3 | ±7.5 | 30 | ±25 | 1 | 6 | 40 | 1000 |
| **XF86SB** | 86.5125 | 3 | ±10 | 20 | ±25 | 1 | 6 | 40 | 200 |
| **XF90UB3** | 90.000 | 3 | ±13 | 40 | ±50 | 1 | 6 | 40 | 200 |
| **XF95UB3** | 95.700 | 3 | ±13 | 35 | ±50 | 1 | 6 | 40 | 200 |

### TYPICAL PERFORMANCE

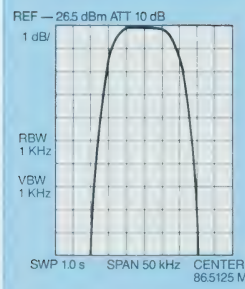
**XF45UB5**



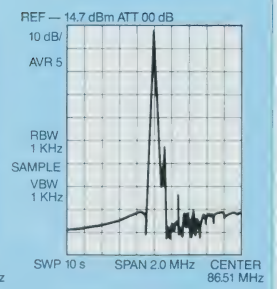

**XF45UB5**




**XF86SB**

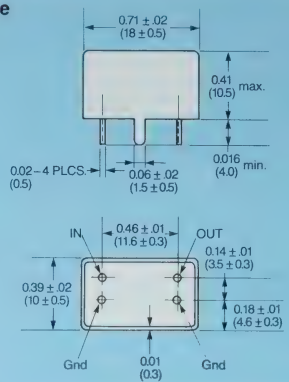



**XF86SB**



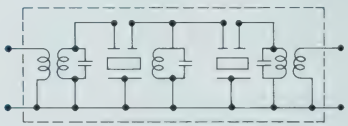

### DIMENSIONS: in. (mm)

**M-4T3 Type**

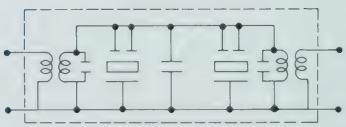



### INTERNAL CIRCUIT

**Overtone Type**



**Fundamental Type**



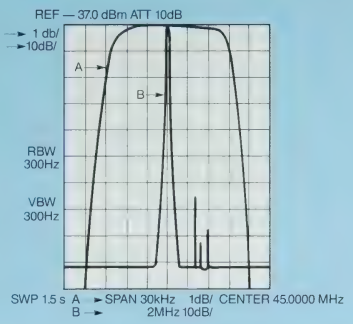
# Fundamental Mode 45 to 58MHz

## SPECIFICATIONS

| Model | XF 45RBB | XF 58RB2 |
|---|---|---|
| Center frequency | 45.000MHz | 58.1125MHz |
| Mode | Fundamental | |
| Pass Bandwidth | 3dB ± 7.5KHz | 3dB ± 8.5KHz |
| Attenuation Bandwidth | 25dB at ±22KHz | 25dB at ±25KHz<br>60dB at ±75KHz |
| Insertion Loss | 3dB | 4dB |
| Ripple | 1dB | 2dB |
| Terminating Impedance | 800Ω // 2.0pF | 380Ω // 3.5pF |
| Temperature Range | −25°C to +85°C | −25°C to +85°C |

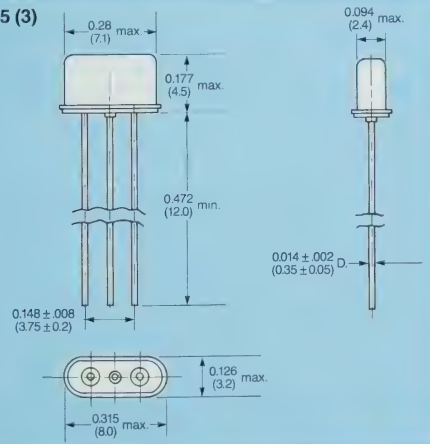
## TYPICAL PERFORMANCE

**XF45RBB**



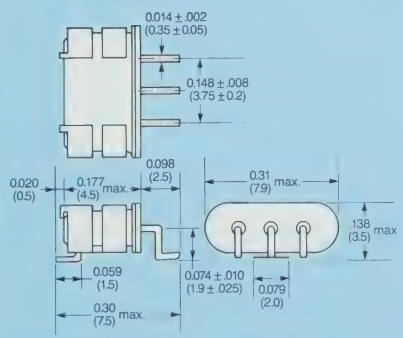

## DIMENSIONS: in. (mm)

**TR-1-4-5 (3)**




## OPTIONAL SMD TYPE

**TR-1-4.5 (3) with metal clamp**




**Dimensions: in. (mm)**

# RESOMICS® CERAMICS FOR MICROWAVE APPLICATIONS

Ceramic dielectrics with high permittivity are known to be excellent resonators for microwave oscillators and filters. Murata Erie microwave ceramics (Resomics) have high dielectric constants, extremely high temperature stability, and high Q that enables the design of stable microwave oscillators and filters. High dielectric materials and associated products are also available for custom application requirements.

## BASIC RESOMIC THEORY

### Unloaded Q

The high dielectric constant confines the electromagnetic field to the geometry of the dielectric resonator material. With radiation losses virtually eliminated, the unloaded Q is determined essentially by the material's internal loss and by the copper loss of the case. Since there are no significant magnetic losses in the dielectric material, the losses are determined by electric losses—i.e., the loss tangent and

$$Q = \frac{1}{\tan \delta}.$$

### Resonator Dimensions

Note that

$$\lambda g = \frac{\lambda}{\sqrt{k}}$$

where $\lambda$ = the free air wave length and $k$ = the resonator dielectric constant, so that size reduction is proportional to the inverse square root of the dielectric constant (i.e., $1/\sqrt{k}$).

Finally, in order to minimize shielding effects of the case, the case dimensions should be approximately twice that of the resonator.

### Temperature Coefficient

The temperature coefficient of the resonant frequency is designated as

$$\tau_f \cong -\alpha - \frac{\tau_\varepsilon}{2}$$

where $\tau_f$ is the temperature coefficient of the resonant frequency,
$\alpha$ is the expansion coefficient of the resonator, and
$\tau_\varepsilon$ is the temperature coefficient of the dielectric constant.

### Configuration of the Resonator

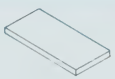
The disc-shaped (DRD series) and the cylinder-shaped (DRT series) are the most feasible from an applications point of view.

a. The lowest resonant mode exists as shown in Fig. 1 on page 33.
b. Fig. 2 illlustrates resonant frequency changes as a function of the ratio of L/D and shows that maximum fundamental-spurious mode separation occurs for an L/D ratio of 0.408.*

### Typical Applications

Fig. 3, 4 and 5 are typical examples of operating principles, substrate layout and circuit diagrams. These can achieve temperature stabilities of ±200 KHz from −20 to +60 degrees C at operational frequencies of 9 to 14 GHz (Fig. 6).**

## TYPICAL CONFIGURATIONS & APPLICATIONS

| | Type | Configuration | Appllication |
|---|---|---|---|
| **Dielectric Resonator (Resomics)** | DRD | Disc | Filters and Oscillators<br>Resonant circuit Microwave Integrated Circuit applications. |
| | DRT | Coaxial Cylinder | Filters and Oscillators<br>Cylindrical types improve spurious response and facilitates mounting. |
| **Dielectric Substrate** | DBR | Substrate  | MIC<br>High Q, high dielectric constant substrate permits size reduction for Microwave Integrated Circuits. |
| **Dielectric Bar** | DAR | Bar | Dielectric resonator waveguide<br>Delay line<br>High Dielectric constant, high Q bar permits small cavity or waveguide dimensions with good temperature stability. |
| **Support** | DRZ | Coaxial Support | Low dielectric constant, high Q support minimizes coupling and induced losses to the resonator. |
| **Screw** | DRZP | Coaxial Support Screw | Polycarbonate material offers low dielectric constant with low thermal expansion coefficient. |

## ELECTRICAL AND PHYSICAL CHARACTERISTICS OF DIELECTRIC RESONATORS

| Material Code | U | R | M | E | Z |
|---|---|---|---|---|---|
| Application | Dielectric Resonator | Dielectric Resonator | Dielectric Resonator | Dielectric Resonator | Support |
| Dielectric Constant ($\varepsilon_r$) | 36 to 40 | 29 to 31 | 37 to 39 | 36 to 40 | 6.4±0.6 |
| Temp. Coefficient (ppm/°C) | $\tau_f$*=−4 to 10 | $\tau_f$*=0 to 6 | $\tau_f$*=0 to 6 | $\tau_f$*=0 to 6 | $\tau_\varepsilon$*=100±30 |
| Q (=1/tan $\delta$) | 6000 min. (at 7GHz) | 12000 min. (at 10GHz) | 7000 min. (at 7GHz) | 20000 min. (at 10GHz) | 2000 min. (at 7GHz) |
| Ins. Resistance (Ω • cm) | $1\times10^{13}$min. | $1\times10^{13}$min. | $1\times10^{13}$min. | $1\times10^{14}$min. | $1\times10^{13}$min. |
| Expansion Coefficient (ppm/°C) | 6 to 7 | 10.7 | 6 to 7 | 10.7 | to 10 |
| Thermal Conductivity (cal/cm • Sec • °C) | 0.0046 | 0.0051 | 0.0046 | 0.0077 | 0.0042 |
| Specific Heat (cal/g • °C) | 0.15 | 0.050 | 0.15 | 0.077 | 0.20 |
| Density (g/cm3) | 5.0 | 7.7 | 5.0 | 7.5 | 2.7 |
| Water Absorption (%) | 0.01 max. | 0.01 max. | 0.01 max. | 0.01 max. | 0.01 max. |
| Vicker's Hardness Number | 900 | 700 | 900 | 800 | 800 |
| Bend Strength (kg/cm) | 1000 | 900 | 1000 | 1200 | 1500 |

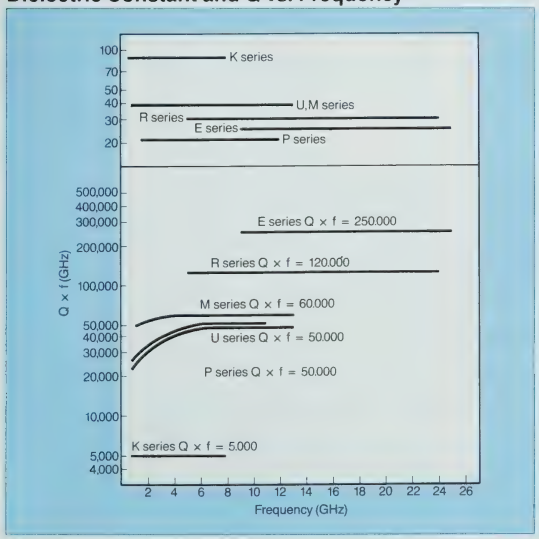
*$\tau_f$ denotes temperature coefficient of resonant frequency and $\tau_\varepsilon$ denotes temperature coefficient of dielectric constant.

## ELECTRICAL AND PHYSICAL CHARACTERISTICS OF DIELECTRIC SUBSTRATES

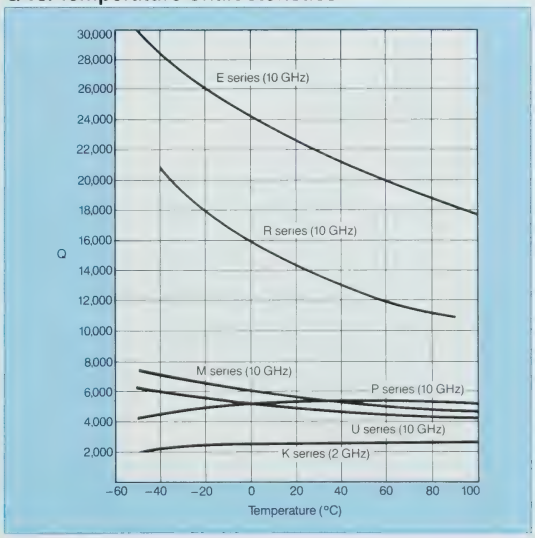
| Material Code | H | P | K |
|---|---|---|---|
| Dielectric Constant ($\varepsilon_r$) | 38±1 | 21.4±1 | 91±3 |
| Temp. Coefficient (ppm/°C) | $\tau_\varepsilon$*=−30±30 | $\tau_\varepsilon$*=−30±30 | $\tau_\varepsilon$*=−30±30 |
| Q (=1/tan $\delta$) | 8000 min. (at 3 GHz) | 9000 min. (at 3GHz) | 1000 min. (at 3 GHz) |
| Ins. Resistance (Ω • cm) | $1\times10^{13}$min. | $1\times10^{13}$min. | $1\times10^{13}$min. |
| Expansion coefficient (ppm/°C) | 6 to 7 | 8 to 9 | 8 to 9 |
| Thermal Conductivity (cal/cm • Sec • °C) | 0.0046 | 0.0170 | 0.0039 |
| Specific Heat (cal/g • °C) | 0.15 | 0.20 | 0.13 |
| Density (g/cm3) | 5.0 | 3.7 | 5.7 |
| Water Absorption (%) | 0.01 max. | 0.01 max. | 0.01 max. |
| Vicker's Hardness Number | 900 | 800 | 700 |
| Bend Strength (kg/cm) | 1000 | 1500 | 1500 |

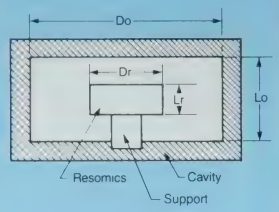
*$\tau_\varepsilon$ denotes temperature coefficient of dielectric constant.

### Dielectric Constant and Q vs. Frequency


K series
U,M series
R series
E series
P series
E series Q × f = 250,000
R series Q × f = 120,000
M series Q × f = 60,000
U series Q × f = 50,000
P series Q × f = 50,000
K series Q × f = 5,000
Q × f (GHz)
Frequency (GHz)

### Q vs. Temperature Characteristics






## I. DIMENSIONAL

| | Material | |
|---|---|---|
| | R | U |
| Diameter | Dr×fo=57.8 | Dr×fo=52.8 |
| Lr/Dr Ratio | 0.44 | 0.44 |

**NOTE 1:** The value of Dr×fo is accurate under the following condition:
a. Dr,Lr in millimeter and fo in GHz.
b. Resomics® is positioned at the center of cavity and Do/Dr=Lo/Lr=3.
c. Lr/Dr=0.44.

**NOTE 2:** Find standard part number dimensions for first approximation. In part number table, Lr/Dr is always 0.44 and this ratio gives the lower frequency in the Frequency Range column. The height of the Resomics® is ground until Lr/Dr=0.32, and this ratio gives the upper frequency in the Frequency Range column (in the same cavity).

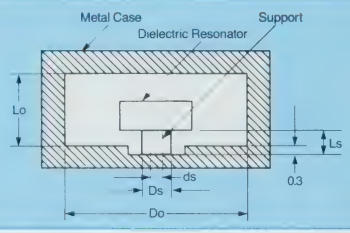
**NOTE 3:** Frequency will vary with the support height or different boundary conditions (i.e., cavity dimensions).

## II. Q FACTOR

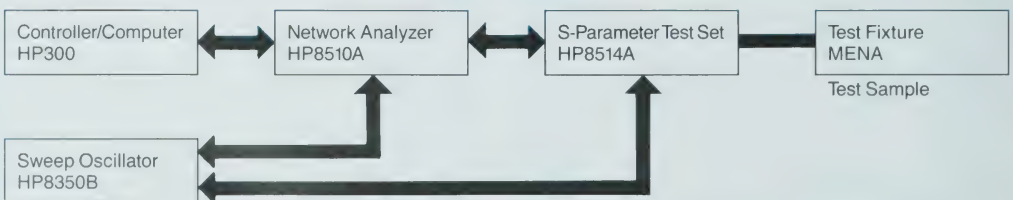
| | Material | |
|---|---|---|
| | R | U |
| Q | $\geq \frac{120{,}000}{Fo}$ | $\geq \frac{100{,}000}{2.0 \times fo + 2.6}$ |

Note: fo (GHz)

## CAVITY FOR (fo) MEASUREMENT DRG0443 (METAL CAVITY) SERIES




| Part Number | Cavity | | Support | | | Applicable Part Number |
|---|---|---|---|---|---|---|
| | Do(mm) | Lo(mm) | Ds(mm) | ds(mm) | Ls(mm) | |
| DRG0443-00 | 16.50 | 7.32 | 3.00 | 2.00 | 2.43 | DRD046 to 055 |
| DRG0443-01 | 23.07 | 10.23 | 4.20 | 3.00 | 3.35 | DRD060 to 077 |
| DRG0443-02 | 32.25 | 14.31 | 5.90 | 3.00 | 4.61 | DRD084 to 107 |
| DRG0443-03 | 45.06 | 19.98 | 8.20 | 4.03 | 6.31 | DRD117 to 150 |
| DRG0443-04 | 63.00 | 27.98 | 11.50 | 6.70 | 8.70 | DRD163 to 210 |
| DRG0443-05 | 88.05 | 39.06 | 15.82 | 7.75 | 12.06 | DRD228 to 293 |
| DRG0443-06 | 123.06 | 54.57 | 22.20 | 11.14 | 17.40 | DRD319 to 347 |




**Q MEASUREMENT NOTES:**
1. Probes shall be decoupled by −30dB below max. coupling through Resonator.
2. $Q = \frac{fo/\triangle f}{1 - 10^{-Ins\ Loss\ (dB)/20}}$ where fo is measured center frequency and △f is 3dB bandwidth.

## III. BOUNDARY EFFECTS

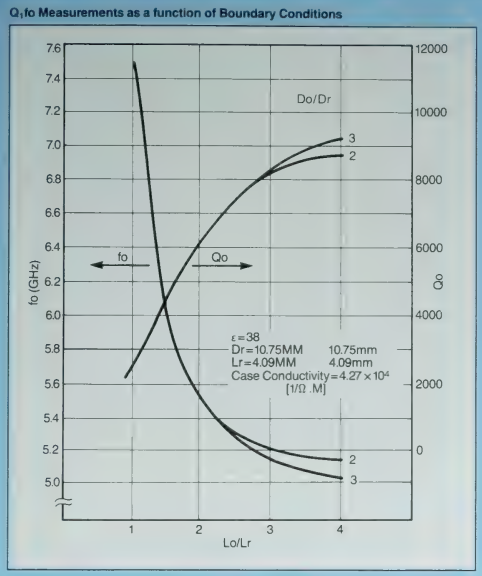
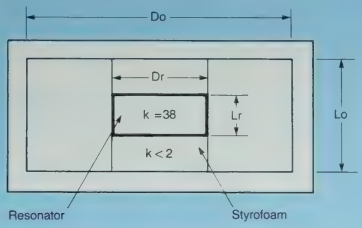



Illustration of the effects of the Boundary Conditions on fo, Qo for U Material Dielectric Resonator (k=38).

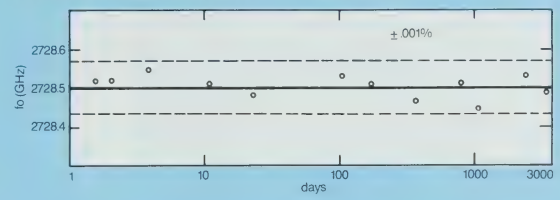



| | Disc | Cylinder |
|---|---|---|
| Figure | D, L | $D_o$, $D_i$, L |
| Electric Field (top) | | |
| Magnetic Field (side) | | |

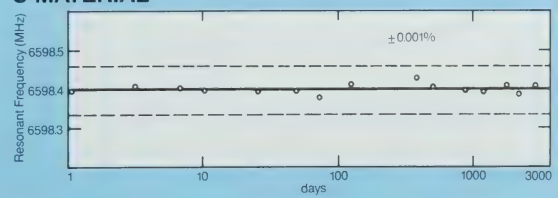
**Fig. 1:** Typical Configuration and Electric-Magnetic Fields

## IV. AGING CHARACTERISTICS

### LONG TERM STABILITY—K MATERIAL




### U MATERIAL




**Note:** S material currently under test. Inquire.

## V. SPURIOUS MODES

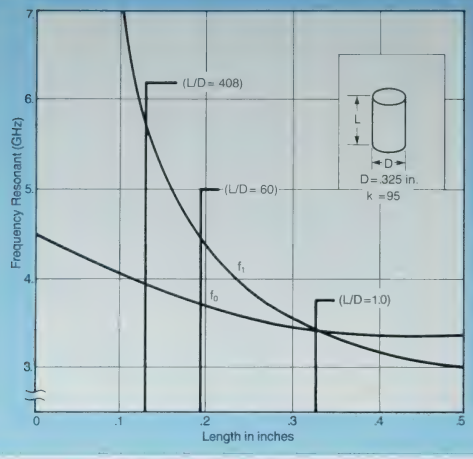



**Fig. 2: $f_1$ Spurious Modes.**
$f_o$: fundamental $TE_{01\delta}$ mode
$f_1$: adjacent spurious
Diameter = .325 inches
As L approaches D,
$f_1$ approaches fo

## VI. TYPICAL APPLICATION—OSCILLATOR CIRCUIT USING A DIELECTRIC RESONATOR

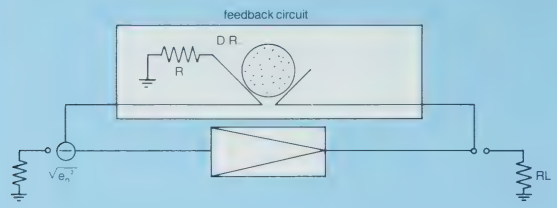



**Fig. 3:** Basic concept for DRO

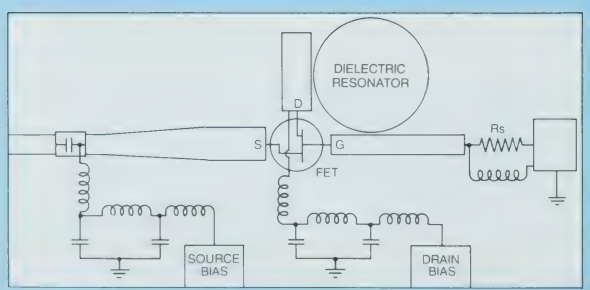



**Fig. 4:** MIC pattern for DRO

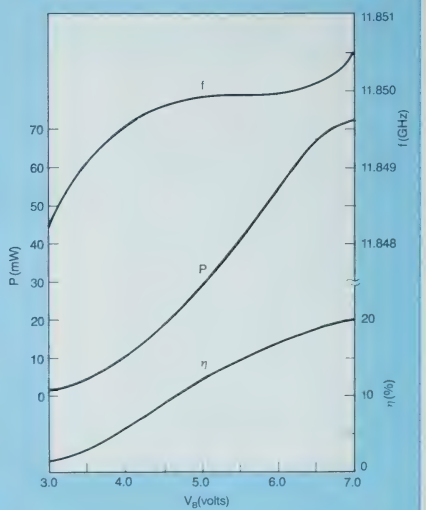
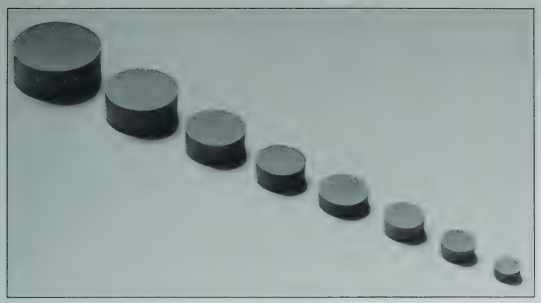



**Fig. 5:** Oscillator characteristics as a function of bias voltage

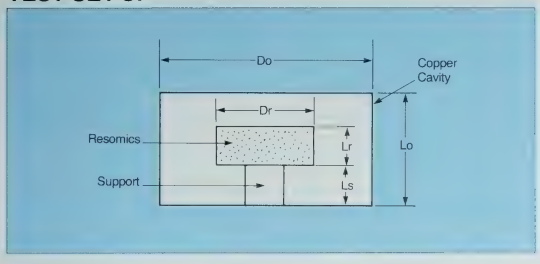
# DRD
# DISC RESONATORS–U Series



## GENERAL CHARACTERISTICS

- Resonant frequency temperature coefficient from −4 to +10ppm/°C.
- Accurate and repeatable dielectric constant (±0.5, see $\tau_f$ tolerance).
- High Q—6000 min. at 7 GHz.
- High dielectric constant—$\varepsilon_r \approx 38$.

## TEST SET-UP




## TABLE 1: Q & $\tau_f$

| Type | Temp. Coeff. $\tau_f$ (ppm/°C) | Dielectric Constant $\varepsilon r$ (±0.5) | Q (at 7GHz) |
|---|---|---|---|
| A | −4 | 36.6 | 6000 min. |
| B | −2 | 37.0 | |
| C | 0 | 37.4 | |
| D | 2 | 37.7 | |
| E | 4 | 38.0 | |
| F | 6 | 38.3 | |
| G | 8 | 38.6 | |
| H | 10 | 38.9 | |

Q as a function of frequency: $Q \geq \dfrac{100{,}000}{2.0 \times Fo + 2.6}$, Fo=[GHz]

## TABLE 2: $\tau_f$ TOLERANCE

| Identification | $\tau_f$ Tol. (ppm/°C) |
|---|---|
| — | ±2 |
| A | ±1 |
| B | ±0.5 |

## DIMENSIONS & FREQUENCY

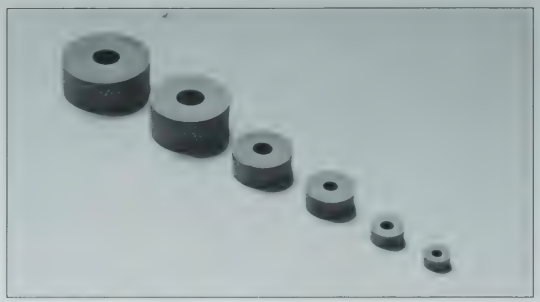
| Part Number | Dr±0.05 (mm) | Lr±0.05 (mm) | Frequency Range* (GHz) |
|---|---|---|---|
| DRD046U□021 | 4.65 | 2.08 | 11.46 to 12.45 |
| DRD051U□022 | 5.06 | 2.24 | 10.54 to 11.45 |
| DRD055U□024 | 5.50 | 2.44 | 9.69 to 10.53 |
| DRD060U□027 | 5.98 | 2.65 | 8.91 to 9.68 |
| DRD065U□029 | 6.50 | 2.88 | 8.20 to 8.90 |
| DRD071U□031 | 7.07 | 3.14 | 7.54 to 8.19 |
| DRD077U□034 | 7.69 | 3.41 | 6.93 to 7.53 |
| DRD084U□037 | 8.36 | 3.71 | 6.38 to 6.92 |
| DRD091U□040 | 9.09 | 4.03 | 5.87 to 6.37 |
| DRD099U□044 | 9.88 | 4.38 | 5.40 to 5.86 |
| DRD107U□048 | 10.75 | 4.77 | 4.96 to 5.39 |
| DRD117U□052 | 11.68 | 5.18 | 4.56 to 4.95 |
| DRD127U□056 | 12.70 | 5.63 | 4.20 to 4.55 |
| DRD138U□061 | 13.81 | 6.13 | 3.86 to 4.19 |
| DRD150U□067 | 15.02 | 6.66 | 3.55 to 3.85 |
| DRD163U□072 | 16.33 | 7.24 | 3.27 to 3.54 |
| DRD178U□079 | 17.76 | 7.88 | 3.00 to 3.26 |
| DRD193U□088 | 19.31 | 8.56 | 2.76 to 2.99 |
| DRD210U□093 | 21.00 | 9.31 | 2.54 to 2.75 |
| DRD228U□101 | 22.83 | 10.13 | 2.34 to 2.53 |
| DRD248U□110 | 24.82 | 11.01 | 2.15 to 2.33 |
| DRD270U□120 | 26.99 | 11.97 | 1.98 to 2.14 |
| DRD293U□130 | 29.35 | 13.02 | 1.82 to 1.97 |
| DRD319U□142 | 31.91 | 14.15 | 1.67 to 1.81 |
| DRD347U□154 | 34.70 | 15.39 | 1.54 to 1.66 |

Notes:
*Frequency is measured under the condition:
Lr/Lo = 0.33.

## PART NUMBERING

| DRD | 055 | U | E | 024 | A |
|---|---|---|---|---|---|
| Disc type resonator | Material diameter in mm (× 10) | Material type | $\tau_f$ (Resonant Freq. T.C.) as shown in Table 1 | Thickness in mm (× 10) | $\tau_f$ tolerance as shown in Table 2 |

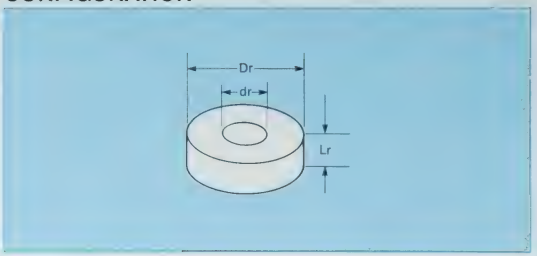
# DRT
# CYLINDRICAL RESONATORS–U Series



## GENERAL CHARACTERISTICS

- High Q—6,000 min. at 7 GHz.
- High dielectric constant—$\varepsilon_r \approx 38$.
- Resonant frequency temperature coefficient from −4 to +10ppm/°C.
- Accurate and repeatable dielectric constant (±0.5).
- Improved spurious response (spurious modes are further removed from fundamental resonant frequency).
- Decoupled mounting on supports above substrate maximizes operational Q.

## CONFIGURATION




## TABLE 1: Q & $\tau_f$

| Type | Temp. Coeff. $\tau_f$ (ppm/°C) | Dielectric Constant $\varepsilon r$ (±0.5) | Q (at 7GHz) |
|---|---|---|---|
| A | −4 | 36.6 | 6000 min. |
| B | −2 | 37.0 | |
| C | 0 | 37.4 | |
| D | 2 | 37.7 | |
| E | 4 | 38.0 | |
| F | 6 | 38.3 | |
| G | 8 | 38.6 | |
| H | 10 | 38.9 | |

Q as a function of frequency: $Q \geq \dfrac{100{,}000}{2.0 \times Fo + 2.6}$ Fo=[GHz]

## TABLE 2: $\tau_f$ TOLERANCE

| Identification | $\tau_f$ Tol. (ppm/°C) |
|---|---|
| — | ±2 |
| A | ±1 |
| B | ±0.5 |

## DIMENSIONS & FREQUENCY RANGE

| Part Number | Dr±0.05 (mm) | dr±0.1 (mm) | Lr±0.05 (mm) | Frequency Range* (GHz) |
|---|---|---|---|---|
| DRT051U020□022 | 5.06 | 2.0 | 2.24 | 10.54 to 11.45 |
| DRT055U020□024 | 5.50 | | 2.44 | 9.69 to 10.53 |
| DRT060U020□027 | 5.98 | | 2.65 | 8.91 to 9.68 |
| DRT065U020□029 | 6.50 | | 2.88 | 8.20 to 8.90 |
| DRT071U020□031 | 7.07 | | 3.14 | 7.54 to 8.19 |
| DRT077U020□034 | 7.69 | | 3.41 | 6.93 to 7.53 |
| DRT084U030□037 | 8.36 | 3.0 | 3.71 | 6.38 to 6.92 |
| DRT091U030□040 | 9.09 | | 4.03 | 5.87 to 6.37 |
| DRT099U030□044 | 9.88 | | 4.38 | 5.40 to 5.86 |
| DRT105U030□046 | 10.50 | | 4.60 | 5.08 to 5.51 |
| DRT107U040□048 | 10.75 | 4.0 | 4.77 | 4.96 to 5.39 |
| DRT117U040□052 | 11.68 | | 5.18 | 4.56 to 4.95 |
| DRT127U040□056 | 12.70 | | 5.63 | 4.20 to 4.55 |
| DRT138U040□061 | 13.81 | | 6.13 | 3.86 to 4.19 |
| DRT150U040□067 | 15.02 | | 6.66 | 3.55 to 3.85 |
| DRT163U040□072 | 16.33 | | 7.24 | 3.27 to 3.54 |
| DRT178U040□079 | 17.76 | | 7.88 | 3.00 to 3.26 |
| DRT193U040□086 | 19.31 | | 8.56 | 2.76 to 2.99 |
| DRT200U040□086 | 20.00 | | 8.63 | 2.67 to 2.89 |
| DRT200U060□086 | 20.00 | 6.0 | 8.63 | 2.66 to 2.88 |

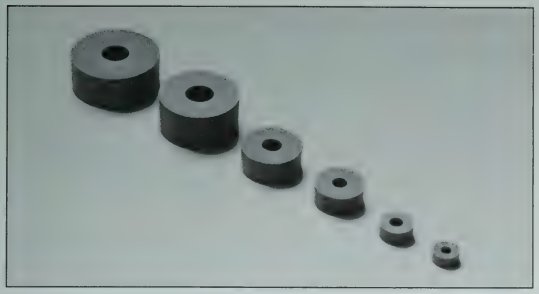
**Notes:**
*Frequency is measured under the condition:
Lr/Lo = 0.33.

## PART NUMBERING

DRT 055 U 020 □ 024 A

| Cylindrical type resonator | Outside diameter (Dr) in mm (×10) | Material type | Inside diameter (dr) in mm (×10) | $\tau_f$ (Resonant Freq., T.C.) as shown in Table 1 | Thickness (Lr) in mm (×10) | $\tau_f$ tolerance as shown in Table 2 |
|---|---|---|---|---|---|---|

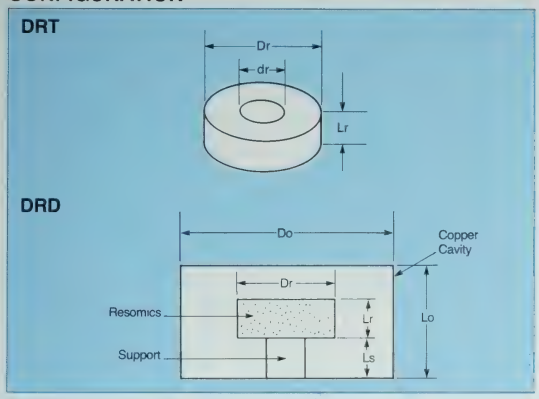
# DRT & DRD
# CYLINDRICAL RESONATORS—M Series



## GENERAL CHARACTERISTICS

- High Q—7,000 min. at 7 GHz.
- High dielectric constant—$\varepsilon_r \approx 38$.
- Resonant frequency temperature coefficient can be chosen from 0 to 6ppm/°C. Tolerance of frequency temperature coefficient can be chosen from ±0.5, ±1, and ±2 ppm/°C.

## CONFIGURATION




## TABLE 1: Q & $\tau_f$

| Characteristic Code | Frequency Temperature Coefficient ($\tau_f$) (ppm/°C) | Dielectric Constant ($\varepsilon_r$) | Q (at 7GHz) |
|---|---|---|---|
| C | 0 | 37.4±0.5 | 7,400 min. |
| D | 2 | 37.7±0.5 | 7,200 min. |
| E | 4 | 38.0±0.5 | 7,100 min. |
| F | 6 | 38.3±0.5 | 7,000 min. |

Q as a function of frequency: $Q \geq \dfrac{100{,}000}{2.0 \times Fo + 2.6}$ Fo=[GHz]

## TABLE 2: $\tau_f$ TOLERANCE

| Special Code | Tolerance of Frequency Temperature Coefficient (ppm/°C) |
|---|---|
| No Code | ±2 |
| A | ±1 |

## DIMENSIONS & FREQUENCY RANGE
## DRD TYPE

| Part Number | Dr±0.05 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|
| DRD046M□021 | 4.65 | 2.06 | 11.46 to 12.45 |
| DRD051M□022 | 5.06 | 2.24 | 10.54 to 11.46 |
| DRD055M□024 | 5.50 | 2.44 | 9.69 to 10.54 |
| DRD060M□027 | 5.98 | 2.65 | 8.91 to 9.69 |
| DRD065M□029 | 6.50 | 2.88 | 8.20 to 8.91 |
| DRD071M□031 | 7.07 | 3.14 | 7.54 to 8.20 |
| DRD077M□034 | 7.69 | 3.41 | 6.93 to 7.54 |
| DRD084M□037 | 8.36 | 3.71 | 6.38 to 6.93 |
| DRD091M□040 | 9.09 | 4.03 | 5.87 to 6.38 |
| DRD099M□044 | 9.88 | 4.38 | 5.40 to 5.87 |
| DRD107M□048 | 10.75 | 4.77 | 4.96 to 5.40 |
| DRD117M□052 | 11.68 | 5.18 | 4.56 to 4.96 |
| DRD127M□056 | 12.70 | 5.63 | 4.20 to 4.56 |
| DRD138M□061 | 13.81 | 6.13 | 3.86 to 4.20 |
| DRD150M□067 | 15.02 | 6.66 | 3.55 to 3.86 |
| DRD163M□072 | 16.33 | 7.24 | 3.27 to 3.55 |
| DRD178M□079 | 17.76 | 7.88 | 3.00 to 3.27 |
| DRD193M□086 | 19.31 | 8.56 | 2.76 to 3.00 |
| DRD210M□093 | 21.00 | 9.31 | 2.54 to 2.76 |
| DRD228M□101 | 22.83 | 10.13 | 2.34 to 2.54 |
| DRD248M□110 | 24.82 | 11.01 | 2.15 to 2.34 |
| DRD70M□120 | 26.99 | 11.97 | 1.98 to 2.15 |
| DRD293M□130 | 29.35 | 13.02 | 1.82 to 1.98 |
| DRD319M□142 | 31.91 | 14.15 | 1.67 to 1.82 |
| DRD347M□154 | 34.70 | 15.39 | 1.54 to 1.67 |

## DRT TYPE

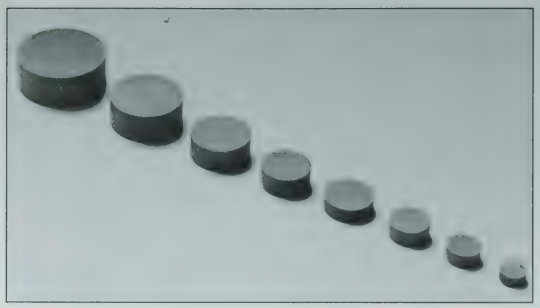
| Part Number | Dr±0.05 (mm) | dr±0.1 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|---|
| DRT051M020□022 | 5.06 | 2.0 | 2.24 | 10.45 to 11.45 |
| DRT055M020□024 | 5.50 | 2.0 | 2.44 | 9.69 to 10.45 |
| DRT060M020□027 | 5.98 | 2.0 | 2.65 | 8.91 to 9.69 |
| DRT065M020□029 | 6.50 | 2.0 | 2.88 | 8.20 to 8.91 |
| DRT071M020□031 | 7.07 | 2.0 | 3.14 | 7.54 to 8.20 |
| DRT077M020□034 | 7.69 | 2.0 | 3.41 | 6.93 to 7.54 |
| DRT084M030□037 | 8.36 | 3.0 | 3.71 | 6.38 to 6.93 |
| DRT091M030□040 | 9.09 | 3.0 | 4.03 | 5.87 to 6.38 |
| DRT099M030□044 | 9.88 | 3.0 | 4.38 | 5.40 to 5.87 |
| DRT107M040□048 | 10.75 | 4.0 | 4.77 | 4.96 to 5.40 |
| DRT117M040□052 | 11.68 | 4.0 | 5.18 | 4.56 to 4.96 |
| DRT127M040□056 | 12.70 | 4.0 | 5.63 | 4.20 to 4.56 |
| DRT138M040□061 | 13.81 | 4.0 | 6.13 | 3.86 to 4.20 |
| DRT150M040□067 | 15.02 | 4.0 | 6.66 | 3.55 to 3.86 |
| DRT163M040□072 | 16.33 | 4.0 | 7.24 | 3.27 to 3.55 |
| DRT178M040□079 | 17.76 | 4.0 | 7.88 | 3.00 to 3.27 |
| DRT193M040□086 | 19.31 | 4.0 | 8.56 | 2.76 to 3.00 |
| DRT210M040□093 | 21.00 | 4.0 | 9.31 | 2.54 to 2.76 |

## PART NUMBERING

DRT 055 M 020 □ 024 A

- DRT: DRD = disk type; DRT = cylindrical type
- 055: Outside diameter (Dr) in mm (×10)
- M: Material type
- 020: Inside diameter (dr) in mm (×10)
- □: $\tau_f$ (Resonant Freq., T.C.) as shown in Table 1
- 024: Thickness (Lr) in mm (×10)
- A: $\tau_f$ tolerance as shown in Table 2

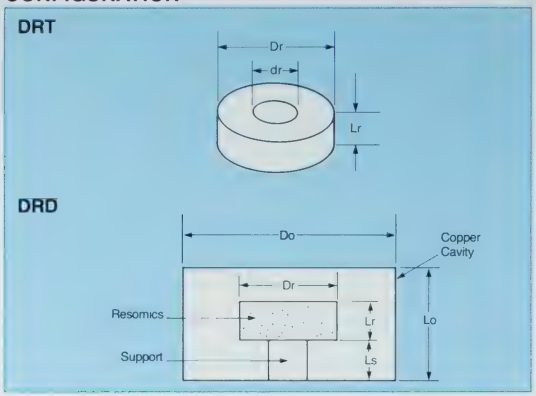
# DRD & DRT
# CYLINDRICAL RESONATORS—R Series



## GENERAL CHARACTERISTICS

- High Q—12,000 min. @ 10 GHz.
- High dielectric constant—$\varepsilon_r \approx 30$.
- The resonant frequency temperature coefficient can be chosen from 0 to 6ppm/°C. Tolerance of the frequency temperature coefficient can be chosen ±0.5, ±1 and ±2ppm/°C.
- Dielectric resonator are chosen from the frequency range of 4.6 to 24.2 GHz in disk type (DRD), and from the frequency range of 5.7 to 13.1 GHz in cylindrical type (DRT).

## CONFIGURATION




## TABLE 1: Q & $\tau_f$

| Characteristic Code | Frequency Temperature Coefficient ($\tau_f$) (ppm/°C) | Dielectric Constant ($\varepsilon_r$) | Q (at 10GHz) |
|---|---|---|---|
| C | 0 | 29.2±0.5 | 12,000min. |
| D | 2 | 29.9±0.5 | |
| E | 4 | 30.6±0.5 | |
| F | 6 | 31.3±0.5 | |

Q as a function of frequency: $Q \geq \dfrac{100{,}000}{2.0 \times Fo + 2.6}$

Fo=[GHz]

## TABLE 2: $\tau_f$ TOLERANCE

| Special Code | Tolerance of Frequency Temperature Coefficient (ppm/°C) |
|---|---|
| No Code | ±2 |
| A | ±1 |
| B | ±0.5 |

## DIMENSIONS & FREQUENCY RANGE
## DRD TYPE

| Part Number | Dr±0.05 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|
| DRD026R□012 | 2.59 | 1.15 | 22.1 to 24.2 |
| DRD028R□013 | 2.82 | 1.25 | 20.4 to 22.1 |
| DRD031R□014 | 3.06 | 1.36 | 18.9 to 20.4 |
| DRD033R□015 | 3.33 | 1.48 | 17.5 to 18.9 |
| DRD036R□016 | 3.62 | 1.61 | 16.2 to 17.5 |
| DRD039R□018 | 3.94 | 1.76 | 15.0 to 16.2 |
| DRD043R□019 | 4.28 | 1.91 | 13.5 to 15.0 |
| DRD046R□021 | 4.65 | 2.06 | 12.6 to 13.5 |
| DRD051R□022 | 5.06 | 2.24 | 11.6 to 12.6 |
| DRD055R□024 | 5.50 | 2.44 | 10.8 to 11.6 |
| DRD060R□027 | 5.98 | 2.65 | 9.7 to 10.8 |
| DRD065R□029 | 6.50 | 2.88 | 9.0 to 9.7 |
| DRD071R□031 | 7.07 | 3.14 | 8.3 to 9.0 |
| DRD077R□034 | 7.69 | 3.41 | 7.7 to 8.3 |
| DRD084R□037 | 8.36 | 3.71 | 6.9 to 7.7 |
| DRD091R□040 | 9.09 | 4.03 | 6.4 to 6.9 |
| DRD099R□044 | 9.88 | 4.38 | 5.9 to 6.4 |
| DRD107R□048 | 10.75 | 4.77 | 5.5 to 5.9 |
| DRD117R□052 | 11.68 | 5.18 | 5.0 to 5.5 |
| DRD127R□056 | 12.70 | 5.63 | 4.6 to 5.0 |

## DRT TYPE

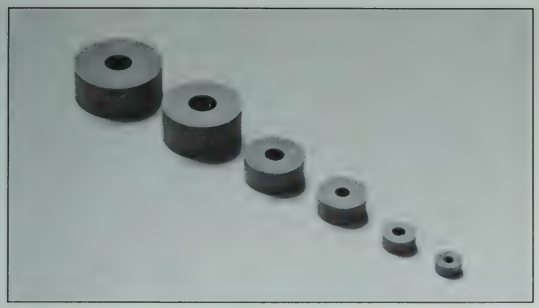
| Part Number | dr±0.05 (mm) | dr±0.1 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|---|
| DRT051R020□022 | 5.06 | 2.0 | 2.24 | 11.9 to 13.1 |
| DRT055R020□024 | 5.50 | 2.0 | 2.44 | 11.0 to 11.9 |
| DRT060R020□027 | 5.98 | 2.0 | 2.65 | 10.0 to 11.0 |
| DRT065R020□029 | 6.50 | 2.0 | 2.88 | 9.1 to 10.0 |
| DRT071R020□031 | 7.07 | 2.0 | 3.14 | 8.4 to 9.1 |
| DRT077R020□034 | 7.69 | 2.0 | 3.41 | 7.7 to 8.4 |
| DRT084R030□037 | 8.36 | 3.0 | 3.71 | 7.1 to 7.7 |
| DRT091R030□040 | 9.09 | 3.0 | 4.03 | 6.5 to 7.1 |
| DRT099R030□044 | 9.88 | 3.0 | 4.38 | 6.0 to 6.5 |
| DRT105R030□046 | 10.50 | 3.0 | 4.60 | 5.7 to 6.0 |

## PART NUMBERING

DRD 055 R 020 □ 024 A

- DRD = disk type, DRT = cylindrical type
- Outside diameter (Dr) in mm (×10)
- Material type
- Inside diameter (dr) in mm (×10)
- $\tau_f$ (Resonant Freq., T.C.) as shown in Table 1
- Thickness (Lr) in mm (×10)
- $\tau_f$ tolerance as shown in Table 2

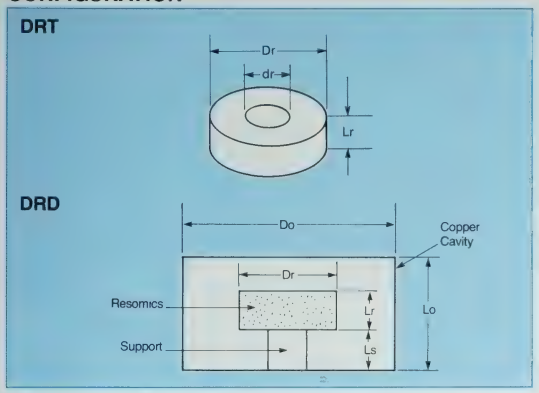
# DRT & DRD
# CYLINDRICAL RESONATORS—E Series



## GENERAL CHARACTERISTICS

- High Q—20,000 min. at 10 GHz.
- High dielectric constant—$\varepsilon_r \approx 24.5$.
- Resonant frequency temperature coefficient can be chosen from 0 to 6ppm/°C. Tolerance of frequency temperature coefficient can be chosen from ±1, ±2 ppm/°C.
- Dielectric resonators are chosen from the frequency range of 8.4 to 25 GHz in disk type (DRD), and from the frequency range of 8.4 to 19.5 GHz in cylindrical type (DRT).
- E-series is also fit for application above 25 GHz. Please consult us.

## CONFIGURATION




## DIMENSIONS & FREQUENCY RANGE
## DRD TYPE

| Part Number | Dr±0.05 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|
| DRD028E□103 | 2.82 | 1.25 | 23.17 to 25.15 |
| DRD031E□014 | 3.06 | 1.36 | 21.27 to 23.17 |
| DRD033E□015 | 3.33 | 1.48 | 19.48 to 21.27 |
| DRD036E□016 | 3.62 | 1.61 | 17.93 to 19.48 |
| DRD039E□018 | 3.94 | 1.76 | 16.47 to 17.93 |
| DRD043E□019 | 4.28 | 1.91 | 15.16 to 16.47 |
| DRD046E□021 | 4.65 | 2.06 | 13.95 to 15.16 |
| DRD051E□022 | 5.06 | 2.24 | 12.82 to 13.95 |
| DRD055E□024 | 5.50 | 2.44 | 11.80 to 12.82 |
| DRD060E□027 | 5.98 | 2.65 | 10.85 to 11.80 |
| DRD065E□029 | 6.50 | 2.88 | 9.98 to 10.85 |
| DRD071E□031 | 7.07 | 3.14 | 9.18 to 9.98 |
| DRD077E□034 | 7.69 | 3.41 | 8.44 to 9.18 |

## TABLE 1: Q & $\tau_f$

| Characteristic Code | Frequency Temperature Coefficient ($\tau_f$) (ppm/°C) | Dielectric Constant ($\varepsilon_r$) | Q (at 10GHz) |
|---|---|---|---|
| C | 0 | 24.2±0.4 | 20,000 min. |
| D | 2 | 24.4±0.4 | |
| E | 4 | 24.7±0.4 | |
| F | 6 | 24.9×0.4 | |

Q as a function of frequency: $Q \geq \dfrac{100{,}000}{2.0 \times Fo + 2.6}$, Fo=[GHz]

## DRT TYPE

| Part Number | Dr±0.05 (mm) | dr±0.1 (mm) | Lr±0.05 (mm) | Frequency Range (GHz) |
|---|---|---|---|---|
| DRT036E013□016 | 3.62 | 1.3 | 1.61 | 17.93 to 19.48 |
| DRT039E013□018 | 3.94 | 1.3 | 1.76 | 16.47 to 17.93 |
| DRT043E013□019 | 4.28 | 1.3 | 1.91 | 15.16 to 16.47 |
| DRT046E020□021 | 4.65 | 2.0 | 2.06 | 13.95 to 15.16 |
| DRT051E020□022 | 5.06 | 2.0 | 2.24 | 12.82 to 13.95 |
| DRT055E020□024 | 5.50 | 2.0 | 2.44 | 11.80 to 12.82 |
| DRT060E020□027 | 5.98 | 2.0 | 2.65 | 10.85 to 11.80 |
| DRT065E020□029 | 6.50 | 2.0 | 2.88 | 9.98 to 10.85 |
| DRT071E020□031 | 7.07 | 2.0 | 3.14 | 9.18 to 9.98 |
| DRT077E020□034 | 7.69 | 2.0 | 3.41 | 8.44 to 9.18 |

## TABLE 2: $\tau_f$ TOLERANCE

| Special Code | Tolerance of Frequency Temperature Coefficient (ppm/°C) |
|---|---|
| No Code | ±2 |
| A | ±1 |

## PART NUMBERING

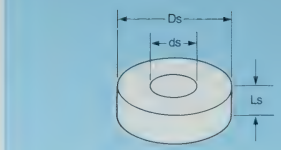
DRT 055 E 020 □ 024 A

- DRT: DRD = disk type, DRT = cylindrical type
- 055: Outside diameter (Dr) in mm (×10)
- E: Material type
- 020: Inside diameter (dr) in mm (×10)
- □: $\tau_f$ (Resonant Freq., T.C.) as shown in Table 1
- 024: Thickness (Lr) in mm (×10)
- A: $\tau_f$ tolerance as shown in Table 2

# DRA
# DIELECTRIC RESONATOR ASSEMBLIES

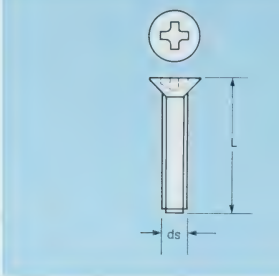
## DRZ SUPPORTS

**The DRZ series are support for the DRT Coaxial Cylinders**

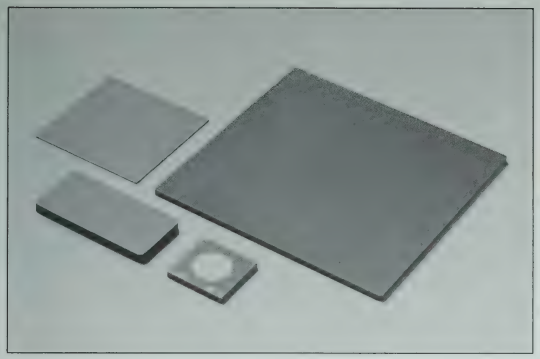
| DIMENSIONS: mm | Part Number | Ds (±0.05) | ds | Ls (±0.05) | Matching DRT P/N | Applicable for Lr/Lo |
|---|---|---|---|---|---|---|
|   | DRZ001A | 3.50 | 2.0 ± .1 | 0.60 | DRT051-DRT077 | Lr/Lo ≈ 0.45 |
| | DRZ002A | | | 1.50 | | Lr/Lo ≈ 0.33 |
| | DRZ003A | 6.00 | 3.0 ± .1 | 1.20 | DRT084-DRT105 | Lr/Lo ≈ 0.45 |
| | DRZ004A | | | 2.50 | | Lr/Lo ≈ 0.33 |
| | DRZ005A | 8.00 | 4.0 ± .1 | 2.00 | DRT107-DRT150 | Lr/Lo ≈ 0.45 |
| | DRZ006A | | | 4.00 | | Lr/Lo ≈ 0.33 |
| | DRZ007A | 10.00 | | 3.50 | DRT163-DRT200 | Lr/Lo ≈ 0.45 |
| | DRZ008A | | | 6.00 | | Lr/Lo ≈ 0.33 |
| | DRZ009A | 12.00 | | 4.00 | DRT200 | Lr/Lo ≈ 0.45 |
| | DRZ010A | | | 7.00 | | Lr/Lo ≈ 0.33 |

**NOTE:** All dimensions in mm. See material characteristics on page 31.

## DRZ MOUNTING SCREW

| DIMENSIONS: mm | Part Number | L(mm) | ds(mm) | Thread |
|---|---|---|---|---|
|   | DRZPM2X10 | 10 | M2 | ISO M2 Thred. pitch 0.4 |
| | DRZPM3X10 | 10 | M3 | ISO M3 Thred. pitch 0.5 |
| | DRZPM3X15 | 15 | M3 | ISO M3 Thred. pitch 0.5 |
| | DRZPM4X15 | 15 | M4 | ISO M4 Thred. pitch 0.7 |
| | DRZPM4X20 | 20 | M4 | ISO M4 Thred. pitch 0.7 |

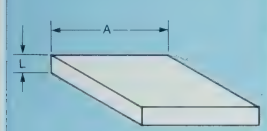
# DBR DIELECTRIC SUBSTRATES



## GENERAL CHARACTERISTICS

- High Dielectric Constant permits large reduction in the size of Microwave Integrated Circuits (MIC).
- High density, low loss material produces extremely high Q factors at microwave frequencies.
- Extremely fine surface finish (0.8 micrometers max.). Suited for MIC application.
- Available with metalized finishes. Please inquire.

## DIMENSIONS: mm




| Part Number | Configuration | A ± 0.1 (mm) | L ± 0.05 (mm) | Dielectric Constant ($\varepsilon_r$) | Linear Expansion Coefficient | Surface Finish ($\mu$m) [Ra] |
|---|---|---|---|---|---|---|
| DBR508H127HGC | Square | 50.8 | 1.27 | 38 ± 1 | 6 to 7 | 0.1 to 0.8 |
| DBR254H063HGC | | 25.4 | 0.63 | | | |
| DBR508P080HGC | | 50.8 | 0.80 | 21.4 ± 1 | 8 to 9 | |
| DBR254P040HGC | | 25.4 | 0.40 | | | |
| DBR508K140HGC | | 50.8 | 1.40 | 91 ± 3 | 8 to 9 | |
| DBR254K070HGC | | 25.4 | 0.70 | | | |

## PART NUMBERING

DBR 254 H 127 HG C 124

- DBR: High dielectric substrate
- 254: Length in mm (×10)
- H: Material type
- 127: Thickness in mm (×100)
- HG: $\tau_f$ Temperature Coefficient of dielectric constant
- C: Surface Finish
- 124: Width in mm (×10) (Not required for square figures)

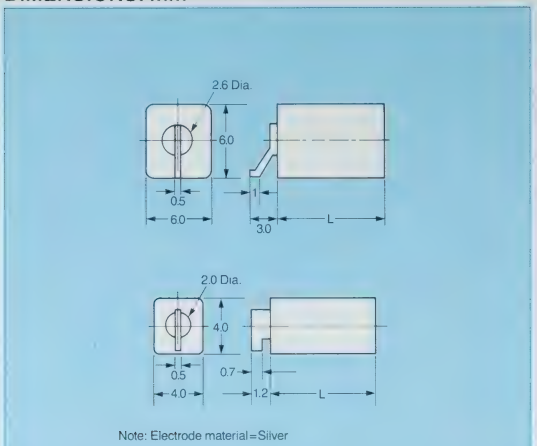
| Material Code | Temp. Coefficient Code | Dielectric Constant ($\varepsilon_r$) | Temp. Coefficient of Dielectric Constant (ppm/°C) | Linear Expansion Coefficient (ppm/°C) |
|---|---|---|---|---|
| H | HG | 38±1 | −30±30 | 6 to 7 |
| P | HG | 21.4±1 | −30±30 | 8 to 9 |
| K | HG | 91±3 | −30±30 | 8 to 9 |

| Surface Finish Code | C | D | F |
|---|---|---|---|
| Average Surface Roughness ($\mu$m) [Ra] | 0.1 to 0.8 | 0.05 to 0.4 | 0.004 to 0.04 |
| Reflective Luster (60°GS) | 1 to 6 | 6 to 50 | 150 |

# DRR
# TEM MODE RESONATOR

## APPLICATIONS
Radio telephone VCO
Measuring instruments OSC
G.P.S. or Geostar OSC
HDTV tuner OSC

## DIMENSIONS: mm




Note: Electrode material=Silver

| Material Code | Resonator Code | L (mm) |
|---|---|---|
| UE | T | L = 12.17 /fo |
| | P | L = 24.33 /fo |
| KE | T | L = 7.862/fo |
| | P | L = 15.724/fo |

fo=Resonant Frequency (GHz)

## ELECTRICAL CHARACTERISTICS

| Material Code | UE | KE |
|---|---|---|
| Dielectric Constant ($\varepsilon_r$) | 38±2 | 91±3 |
| Frequency Range | see Table 1 | |
| Tolerance of Resonant Frequency | ±0.5% | ±0.6% |
| Unloaded Q | see Table 2 | |
| Characteristic Impedance | see Table 3 | |
| Frequency Temp. Coefficient (ppm/°C) | 3±3 for TE mode | 3±5 for TE mode |

## PART NUMBERING

| DRR | 060 | KE | 1R180 | T |
|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ |

❶ Configuration : DRR = TEM mode Resonator
❷ Size : 060 = 6.0mm square
❸ Material : "UE" = U-Series, "KE" = K-Series
❹ Resonant Freq. : "R" = position of decimal point (in steps of 10MHz)
❺ Type of TEM : "T" = λ / 4 TEM mode in 060 type
"P" = λ / 2 TEM mode in 060 type
"TS" = λ / 4 TEM mode in 040 type
"PS" = λ / 2 TEM mode in 040 type

## TABLE 1 : RESONANT FREQUENCY RANGE (MHz)*

| Material Code | Code of Resonator | DRR040 | DRR060 |
|---|---|---|---|
| UE | T (λ / 4) | 1000 to 2700 | 530 to 1800 |
| | P (λ / 2) | 2000 to 4800 | 1600 to 3500 |
| KE | T (λ / 4) | 660 to 1650 | 440 to 1300 |
| | P (λ / 2) | 1300 to 3000 | 1000 to 2200 |

## TABLE 2 : SPECIFICATIONS FOR UNLOADED Q

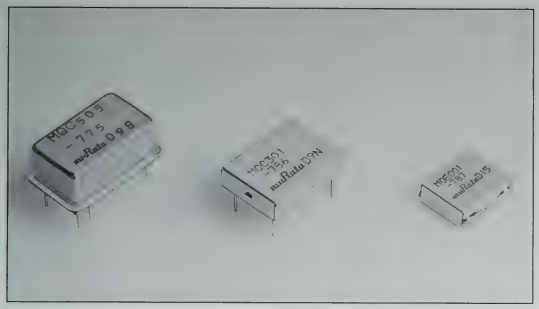
| Material Code | Code of Resonator | DRR040 | DRR060 |
|---|---|---|---|
| UE | T (λ / 4) | 350 min. | 450 min. |
| | P (λ / 2) | 530 min. | 730 min. |
| KE | T (λ / 4) | 270 min. | 340 min. |
| | P (λ / 2) | 380 min. | 500 min. |

## TABLE 3 : CHARACTERISTIC IMPEDANCE

| Material Code | DRR040 | DRR060 |
|---|---|---|
| UE | 7.4 Ω | 8.8 Ω |
| KE | 4.8 Ω | 5.7 Ω |

*NOTE: Resonant frequency must be specified in multiples of 10MHz

# DIELECTRIC RESONATOR-BASED VOLTAGE CONTROLLED OSCILLATORS (VCO)



## FEATURES

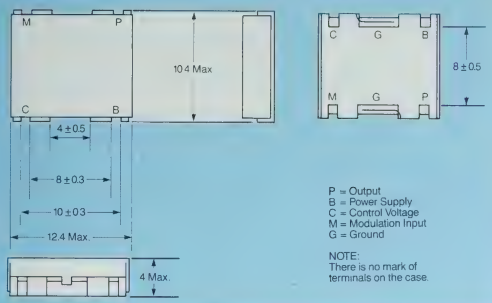
- Small and lightweight
- Low power consumption
- Excellent temperature stability

## APPLICATIONS

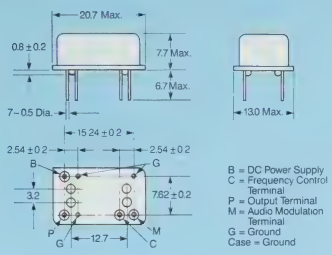
Mobile and Hand Held Telephone
Cordless Telephone (European)
Personal Radio
MCA Radio

## DIMENSIONS: mm

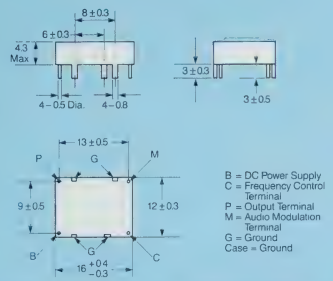
### MQE000 Series



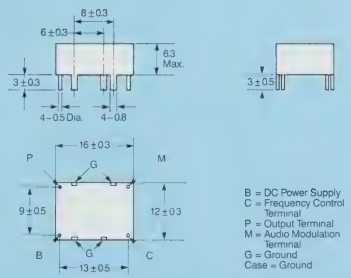

### MQC500 Series




### MQC300 Series




### MQC200 Series




## PART NUMBERING

MQC 505 – 836

- MQC: VCO
- 505: TYPE
- 836: CENTER FREQUENCY (MHz)

# VCO SPECIFICATIONS

## MQC/MQE Series

### EAMPS

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Tx | MQC505-836 | 836.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| | MQC309-836 | 836.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 70 | 45 | −35 to +80 |
| | MQE001-836 | 836.5±12.5 | ≧9.0 | 1.0 to 4.0 | 8 to 12 | ±10 | 70 | 45 | −35 to +80 |
| Rx | MQC505-926 | 926.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC505-964 | 964.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC309-926 | 926.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQC309-964 | 964.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQE001-926 | 926.5±12.5 | ≧9.0 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQE001-964 | 964.5±12.5 | ≧9.0 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |

*Supply Voltage 5±0.25V (MQC508=7.2±0.3V, MQC514=7.0±0.5V, MQE001=4.2V±0.25V)
Output Level −2dBm min. (MQC508=0dBm min., MQE001=−3dBm min.)
Power Consumption 8mA max. (MQC508=12mA max.)

### ETACS

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Tx | MQC505-888 | 888.5±16.5 | 13±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| | MQC309-888 | 888.5±16.5 | 13±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 70 | 45 | −35 to +80 |
| | MQE001-888 | 888.5±16.5 | ≧11.0 | 1.0 to 4.0 | 8 to 12 | ±10 | 70 | 45 | −35 to +80 |
| Rx | MQC505-978 | 978.5±16.5 | 13±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC508-1024 | 1024.5±16.5 | 9±2 | 1.0 to 6.0 | — | — | 75 | 50 | −35 to +80 |
| | MQC309-978 | 978.5±16.5 | 13±2 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQE001-978 | 978.5±16.5 | ≧11.0 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQE001-1025 | 1025.5±16.5 | ≧11.0 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |

*Supply Voltage 5±0.25V (MQC508=7.2±0.5V, MQE001=4.2V±0.25V)
Output Level −2dBm min. (MQC508=0dBm min., MQE001=−3dBm min.)
Power Consumption 8mA max. (MQC508=12mA max.)

### NMT

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Tx | MQC505-902 | 902.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| | MQC202-902 | 902.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| | MQE001-902 | 902.5±12.5 | ≧9.0 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| Rx | MQC505-992 | 992.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC505-1017 | 1017.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC202-992 | 992.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQE001-992 | 992.5±12.5 | ≧9.0 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |

*Supply Voltage 5±0.25V (MQC508=7.2±0.3V, MQE001=4.2V±0.25V)
Output Level −2dBm min. (MQC508=0dBm min., MQE001=−3dBm min.)
Power Consumption 8mA max. (MQC508=12mA max.)

## GSM

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Tx | MQC505-902 | 902.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 72 | 45 | −35 to +80 |
| | MQC309-902 | 902.5±12.5 | 11±2 | 1.0 to 4.0 | 8 to 12 | ±10 | 68 | 45 | −35 to +80 |
| Rx | MQC505-992 | 992.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC505-1017 | 1017.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 72 | 45 | −35 to +80 |
| | MQC309-992 | 992.5±12.5 | 11±2 | 1.0 to 4.0 | — | — | 68 | 45 | −35 to +80 |

*Supply Voltage 5±0.25V Output Level −2dBm min. Power Consumption 8mA max.

## CORDLESS (EUROPEAN) – CEPT40, CEPT80(ANALOG)/CT-2(DIGITAL)

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Tx | MQC506-886 | 886.0±1.0 | 4±2 | 1.5 to 3.5 | 8 to 12 | ±5 | 70 | 45 | −10 to +60 |
| | MQC506-914 | 914.5±0.5 | 3.5±2 | 1.5 to 3.5 | 8 to 12 | ±5 | 70 | 45 | −10 to +60 |
| | MQC506-931 | 931.0±1.0 | 4±2 | 1.5 to 3.5 | 8 to 12 | ±5 | 70 | 45 | −10 to +60 |
| | MQC506-959 | 959.5±0.5 | 3.5±2 | 1.5 to 3.5 | 8 to 12 | ±5 | 70 | 45 | −10 to +60 |
| | MQC513-716 | 716.0±12.5 | 12±2 | 1.0 to 4.0 | 5.6 to 8.4 | ±10 | 75 | 45 | −10 to +60 |
| | MQC308-886 | 886.0±1.0 | 5±2 | 1.0 to 3.5 | 16 to 24 | ±5 | 66 | 45 | −10 to +60 |
| | MQC308-931 | 931.0±1.0 | 5±2 | 1.0 to 3.5 | 16 to 24 | ±5 | 66 | 45 | −10 to +60 |
| Rx | MQC506-828 | 828.0±2.0 | 4±2 | 1.0 to 4.0 | — | — | 70 | 45 | −10 to +60 |
| | MQC506-856 | 856.5±1.5 | 4±2 | 1.5 to 3.5 | — | — | 70 | 45 | −10 to +60 |
| | MQC506-989 | 989.0±2.0 | 4±2 | 1.0 to 4.0 | — | — | 70 | 45 | −10 to +60 |
| | MQC506-1017 | 1017.5±1.5 | 4±2 | 1.5 to 3.5 | — | — | 70 | 45 | −10 to +60 |
| | MQC513-860 | 860.65±7.35 | 8±2 | 1.0 to 4.0 | — | — | 70 | 45 | −10 to +60 |
| | MQC308-827 | 827.9±1.0 | 5±2 | 1.0 to 3.5 | — | — | 68 | 45 | −10 to +60 |
| | MQC308-872 | 872.9±1.0 | 5±2 | 1.0 to 3.5 | — | — | 68 | 45 | −10 to +60 |

*Supply Voltage 5±0.25V (MQC506-828/989=4.5±0.25V, MQC308=4.0±0.2V) Output Level −2dBm min. (MQC308=0±3dBm)
Power Consumption 8mA max.
**Oscillation frequency and supply voltage can be changed upon request. Consult us for further information.

## GPS, MSAT AND SATELLITE RECEIVERS

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| GPS | MQC530-1395 | 1395±4.5 | ≧3.0 | 1.0 to 4.0 | — | — | 70 | — | −40 to +85 |
| | MQC530-1485 | 1485.44±3.0 | ≧3.0 | 1.0 to 4.0 | — | — | 75 | — | −40 to +85 |
| MSAT | MQC530-1465 | 1465±13.0 | ≧6.0 | 2.0 to 6.5 | — | — | 110 | — | −30 to +85 |

*Supply Voltage 5±0.25V Output Level −2dBm min. Power Consumption 8mA max.

# VCO SPECIFICATIONS

## MQC Series

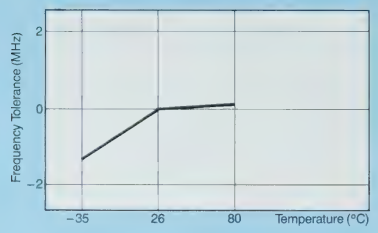
### SPREAD SPECTRUM

| Application | Part Number | Oscillation Frequency (MHz) | Control Volt. Sensitivity (MHz/V) | Tuning Volt. Range (V) | Audio Modulation Sensitivity (KHz/Vp-p) | Audio Modulation Sensitivity Deviation (% max.) | C/N (dBmin.) | S/N (dBmin.) | Operation Temperature (°C) |
|---|---|---|---|---|---|---|---|---|---|
| Spread Spectrum | MQC505-915 | 915.5 ± 12.5 | ≧9.0 | 1.0 to 4.0 | — | — | 70 | 45 | −35 to +80 |
| | MQC515-915 | 915.5 ± 12.5 | ≧9.0 | 1.0 to 4.0 | 100 | ± 10 | 70 | 45 | −35 to +80 |

*Supply Voltage 5 ± 0.25V  Output Level −2dBm min.  Power Consumption 8mA max.

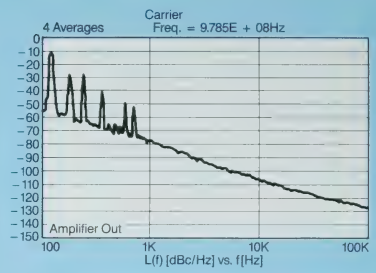
### VCO TYPICAL CHARACTERISTICS (MQC505-978)

#### OSCILLATION FREQUENCY vs. TEMPERATURE CHARACTERISTICS

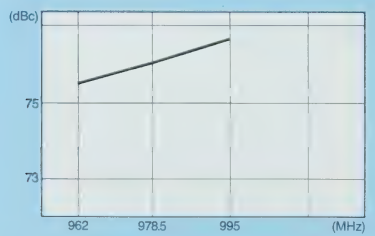



#### C/N LEVEL

**MQC505-978**

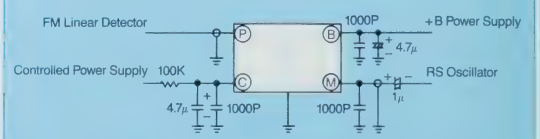



#### C/N LEVEL — OSCILLATION FREQUENCY



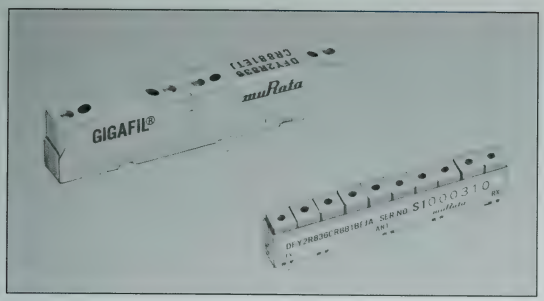

#### TEST CIRCUIT

**MQC500/300/200**



muRata ERIE

# DUPLEXERS—DFY Series




## FEATURES

- Low insertion loss for using high Q-value dielectric resonators.
- Small and light for using high dielectric constant ceramics.
- Excellent temperature stability for temperature compensated dielectric constant (0±5ppm/°C max.)
- Excellent mechanical stability.

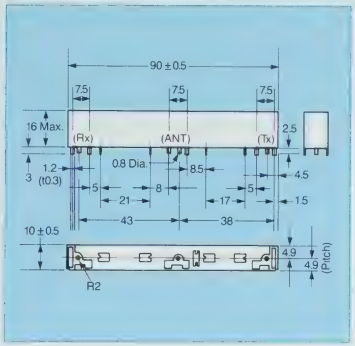
## GENERAL CHARACTERISTICS

| | |
|---|---|
| Characteristic Impedance | 50Ω |
| Operation Temperature (Nominal) | −30°C to +85°C |
| Storage Temperature (Nominal) | −40°C to +90°C |

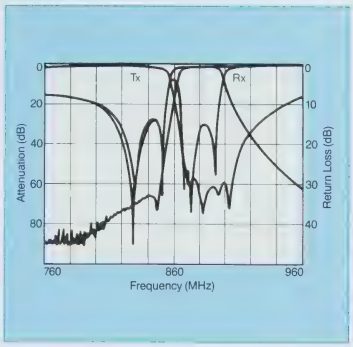
| | |
|---|---|
| Vibration | MIL-STD-202, 204, A |
| Shock | MIL-STD-202, 213, A |
| Humidity | MIL-STD-202, 103, B |
| Heat Shock | MIL-STD-202, 107, A |

## STANDARD DUPLEXER DFY2R836CR881BFDA

## DIMENSIONS: mm




## TRANSMISSION vs. REFLECTION CHARACTERISTICS




## SPECIFICATIONS

| Center Frequency | Bandwidth (BW) | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Maximum Rated Power |
|---|---|---|---|---|---|---|
| Tx 836.5MHz | 25MHz | 2.1dB max. | 1.2dB max. | 1.7 max. | 50dB min. at 869 to 894MHz | 10W |
| | | | | | 40dB min. at 1648 to 1698MHz | |
| | | | | | 30dB min. at 2472 to 2547MHz | |
| Rx 881.5MHz | 25MHz | 3.0dB max. | 1.5dB max. | 1.7 max. | 53dB min. at 824 to 849MHz | — |

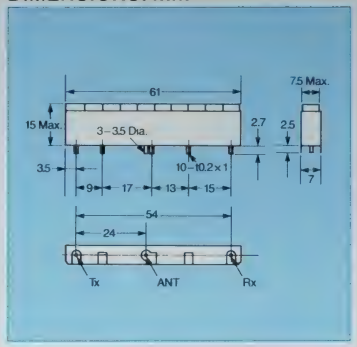
## ALSO AVAILABLE:

| |
|---|
| GSM APPLICATIONS: DFY2R902CR947BFD |

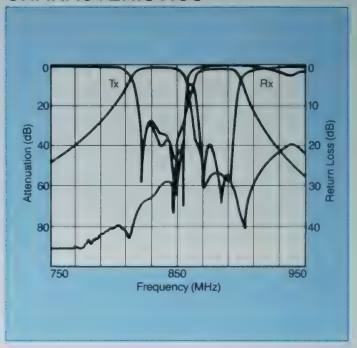
# DUPLEXERS—DFY Series

## STANDARD DUPLEXER (MINIATURE – LOW COST) DFY2R836CR881BFJA

## DIMENSIONS: mm




## TRANSMISSION vs. REFLECTION CHARACTERISTICS

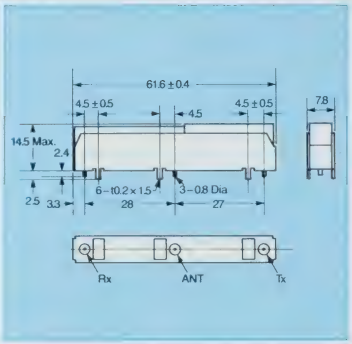



## SPECIFICATIONS

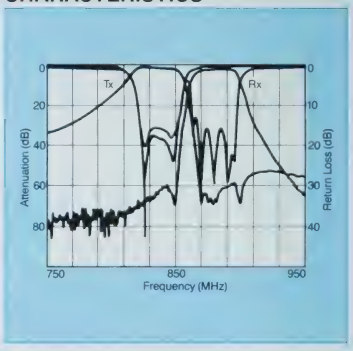
| Center Frequency | Bandwidth (BW) | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Maximum Rated Power |
|---|---|---|---|---|---|---|
| Tx 836.5MHz | 25MHz | 2.6 (+5 to +35°C)<br>2.9 (−30 to +85°C)<br>dB max. | 0.9dB max. | 1.8 max. | 45dB min. at 869 to 894MHz<br>35dB min. at 910 to 936MHz<br>40dB min. at 1648 to 1698MHz<br>15dB min. at 2472 to 2547MHz<br>20dB min. at 0 to 800MHz | 10W |
| Rx 881.5MHz | 25MHz | 3.3 (+5 to +35°C)<br>3.6 (−30 to +85°C)<br>dB max. | 1.2dB max. | 1.7 max. | 80dB min. at 80 to 90MHz<br>55dB min. at 824 to 849MHz<br>15dB min. at 907MHz<br>40dB min. at 932MHz<br>70dB min. at 1035 to 1060MHz | — |

## STANDARD DUPLEXER (SMALL-SIZED) DFY2R836CR881ETJ

## DIMENSIONS: mm




## TRANSMISSION vs. REFLECTION CHARACTERISTICS




## SPECIFICATIONS

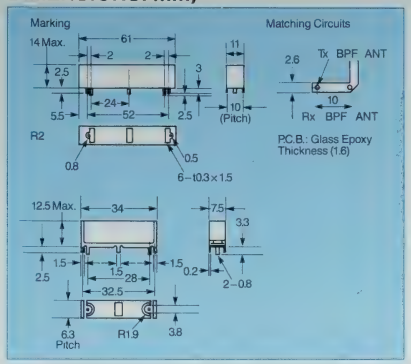
| Center Frequency | Bandwidth (BW) | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Maximum Rated Power |
|---|---|---|---|---|---|---|
| Tx 836.5MHz | 25MHz | 2.0 (−30°C to +40°C)<br>2.2 (+90°C to +85°C)<br>dB max. | 0.9dB max. | 1.7 max. | 45dB min. at 869 to 894MHz<br>40dB min. at 955 to 980MHz<br>30dB min. at 1648 to 1698MHz | 6W |
| Rx 881.5MHz | 25MHz | 3.2dB max. | 1.1dB max. | 1.7 max. | 54dB min. at 824 to 849MHz<br>17dB min. at 910 to 935MHz | — |

*Characteristic Curve 1
**Characteristic Curve 2

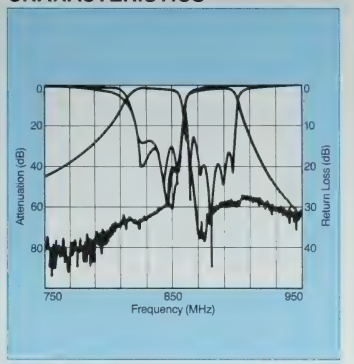
# DUPLEXERS—KMGC Series

## SEPARATED PAIR DUPLEXER KMGC104A

## DIMENSIONS: mm)




## TRANSMISSION vs. REFLECTION CHARACTERISTICS



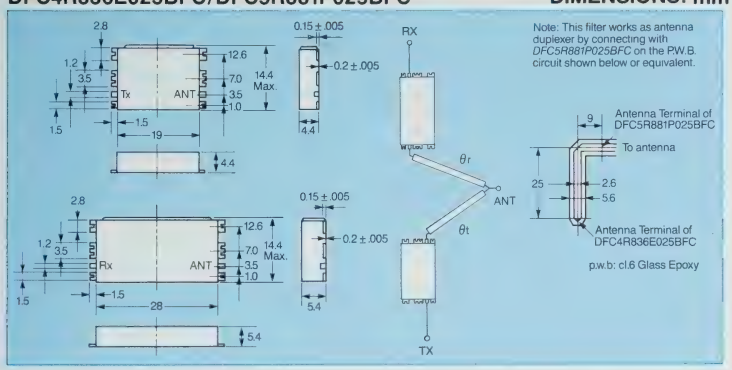

## SPECIFICATIONS

| Part Number | Center Frequency | Bandwidth (BW) | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Maximum Rated Power |
|---|---|---|---|---|---|---|---|
| Tx BPF* | 836.5MHz | 25MHz | 2.3dB max. | 1.0dB max. | 1.7 max. | 50dB min. at 869 to 894MHz | 10W |
| | | | | | | 40dB min. at 1648 to 1698MHz | |
| | | | | | | 20dB min. at 2472 to 2547MHz | |
| Rx BPF** | 881.5MHz | 25MHz | 3.5dB max. | 1.5dB max. | 1.7 max. | 55dB min. at 824 to 849MHz | — |

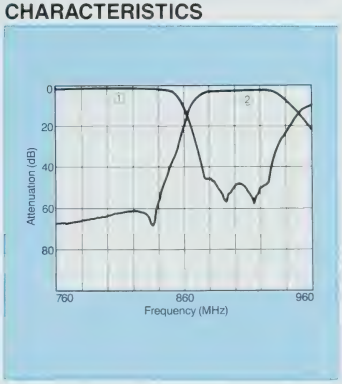
*Characteristic Curve: 1 **Characteristic Curve: 2

## SEPARATED DUPLEXER (ULTRAMINIATURE) DFC4R836E025BFC/DFC5R881P025BFC

## DIMENSIONS: mm




## TRANSMISSION vs. REFLECTION CHARACTERISTICS




## SPECIFICATIONS

| Part Number | Center Frequency | Bandwidth (BW) | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Maximum Length |
|---|---|---|---|---|---|---|---|
| DFC4R836E025BFC* | Tx 836.5MHz | 25MHz | 2.5dB max. | 1.5dB max. | 2.0 max. | 40dB min. at 869 to 894MHz | 2.0W |
| | | | | | | 30dB min. at 1648 to 1698MHz | |
| | | | | | | 28dB min. at 2472 to 2547MHz | |
| DFC5R881P025BFC** | Rx 881.5MHz | 25MHz | 3.8dB max. | 1.8dB max. | 2.0 max. | 56dB min. at 824 to 849MHz | — |

Also avaialble for NMT Applications: DFC4R902E025BFD, DFC5R947P025BFD
*Characteristic Curve: 1 **Characteristic Curve: 2

## OTHER AVAILABLE DUPLEXERS

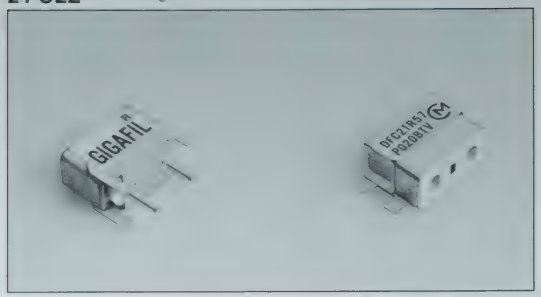
| Application | Part Number |
|---|---|
| E-AMPS | DFY2R836CR881BFA |
| GPS | DFY21R22C1R57BTVA |

| Application | Part Number |
|---|---|
| M-SAT | DFY21R54C1R64BTB |
| LMR | DFY2R815CR860BS |

# MICROWAVE FILTER (GIGAFIL®)

## BPF-DFC Series

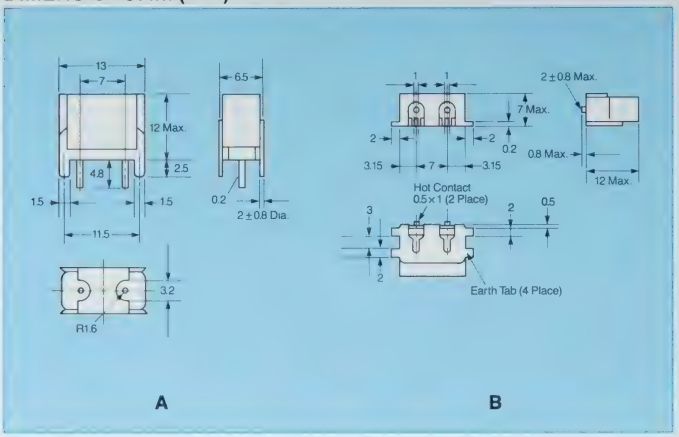
### 2 POLE



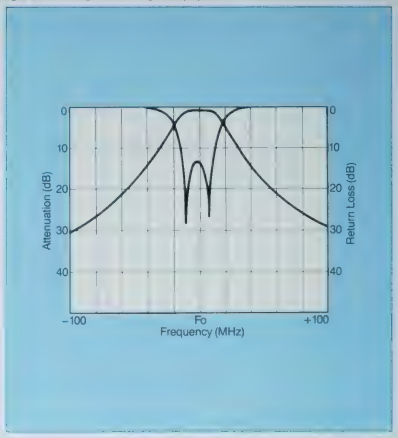

### FEATURES

- Low insertion loss for using high Q-value dielectric resonators.
- Small and light for using high dielectric constant ceramics.
- Excellent temperature stability for temperature compensated dielectric constant (±5ppm/°C max.)
- Excellent mechanical stability for vibratile structure.
- Available for SMD type (B).

### DIMENSIONS: in. (mm)




### TRANSMISSION vs. REFLECTION CHARACTERISTICS




### E-AMPS SPECIFICATIONS

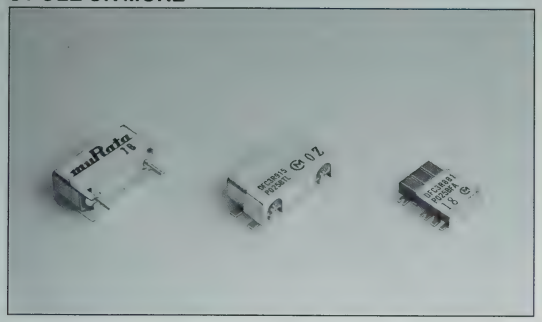
| Part Number | Center Frequency | Bandwidth | Insertion Loss in Bw | Ripple in Bw | V.S.W.R. in Bw | Attenuation | Type |
|---|---|---|---|---|---|---|---|
| DFC2R836P025BTD | 836.5MHz | Fo±12.5MHz | 1.8dB max. | 0.8dB max. | 2.0 max. | 20dB (Fo±77.5MHz) | A |
| DFC2R881P025BTD | 881.5MHz | | | | | | |
| DFC2R926P025BTD | 926.5MHz | | | | | | |
| DFC2R964P025BTD | 964.5MHz | | | | | | |
| DFC2R836P025BTL | 836.5MHz | | | | | | B |
| DFC2R881P025BTL | 881.5MHz | | | | | | |
| DFC2R926P025BTL | 926.5MHz | | | | | | |
| DFC2R964P025BTL | 964.5MHz | | | | | | |

### 2 POLE FILTERS ALSO AVAILABLE FOR

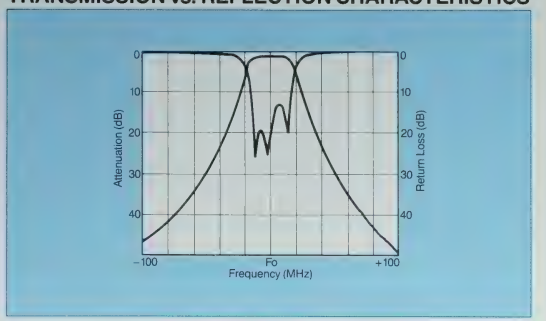
| Application | Part Number |
|---|---|
| GSM | DFC2R902P025BTD |
| | DFC2R902P025BTL |
| | DFC2R947P025BTD |
| | DFC2R947P025BTL |
| GPS | DFC21R57P020BT |
| | DFC21R57P020BTA |
| | DFC21R57P020BTL |
| | DFC21R57P020BTV |
| | DFC21R22P020BT |
| | DFC21R22P020BTL |

| Application | Part Number |
|---|---|
| LMR | DFC2R815P020BTD |
| | DFC2R860P020BTD |
| SST | DFC2R915P025BTD |
| Cordless Phone | DFC2R914P001BTA |
| | DFC2R959P001BTA |
| | DFC2R886P002BTA |
| | DFC2R931P002BTA |

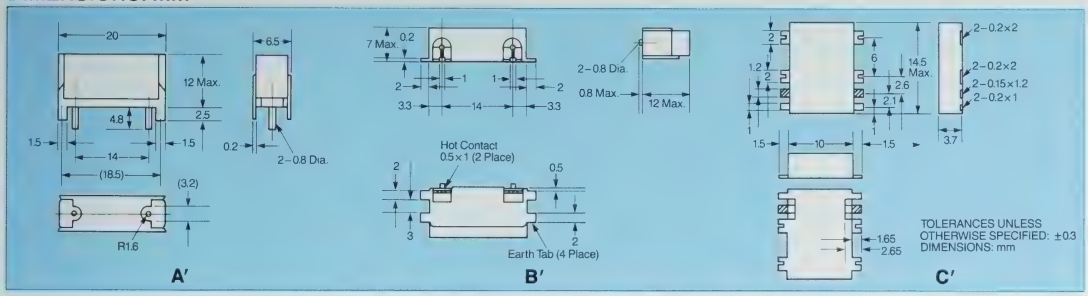
## 3 POLE OR MORE



## TRANSMISSION vs. REFLECTION CHARACTERISTICS




## DIMENSIONS: mm




## E-AMPS SPECIFICATIONS – 3 POLE

| Part Number | Center Frequency | Bandwidth | Insertion Loss in BW | Ripple in BW | V.S.W.R. in BW | Attenuation | Type |
|---|---|---|---|---|---|---|---|
| DFC3R836P025ETD | 836.5MHz | Fo±12.5MHz | 2.0dB max. | 0.8dB max. | 2.0 max. | 12dB (Fo±32.5MHz) | A′ |
| DFC3R881P025ETD | 881.5MHz | | | | | | |
| DFC3R926P025ETD | 926.5MHz | | | | | | |
| DFC3R964P025ETD | 964.5MHz | | | | | | |
| DFC3R836P025BFA | 836.5MHz | | 2.6dB max. | 1.0dB max. | | | C′ |
| DFC3R881P025BFA | 881.5MHz | | | | | | |
| DFC3R926P025BFA | 926.5MHz | | | | | | |
| DFC3R964P025BFA | 964.5MHz | | | | | | |

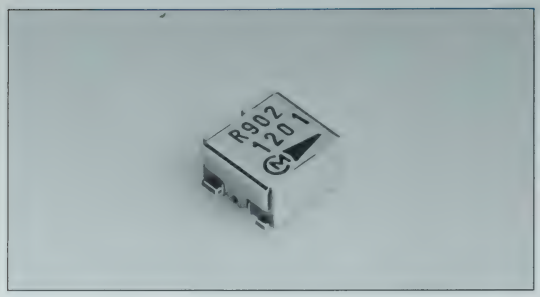
## ALSO AVAILABLE:

| Application | Part Number | |
|---|---|---|
| | 3 POLE | 4 POLE |
| E-AMPS | See Above | DFC4R836P025BFA |
| | | DFC4R836P025ETD |
| | | DFC4R881P025BFA |
| | | DFC4R881P025ETD |
| GSM | DFC3R902P025BFA | DFC4R902P025BFA |
| | DFC3R902P025ETD | DFC4R902P025ETD |
| | DFC3R902P025ETL | DFC4R947P025BFA |
| | DFC3R947P025BFA | DFC4R947P025ETD |
| | DFC3R947P025ETD | — |
| | DFC3R947P025ETL | — |
| SST | DFC3R915P025BTD | DFC4R915P024BTD |
| | DFC3R915P025BTL | — |
| | DFC32R44P084BFA | — |

| Application | Part Number | |
|---|---|---|
| | 3 POLE | 4 POLE |
| MSAT | DFC31R55P046BTD | — |
| | DFC31R64P034BTD | — |
| TCAS | — | DFC41R09P004BTL |
| | — | DFC41R03P006BTL |
| LMR | DFC3R815P020BTD | — |
| | DFC3R860P020BTD | — |
| Cordless Phone | DFC3R914P001BTD | — |
| | DFC3R959P001BTD | — |
| | DFC3R886P002BTD | — |
| | DFC3R931P002BTD | — |
| SkyPhone | — | DFC4R850P002BTU |
| | — | DFC4R895P002BTU |

# MICROWAVE ISOLATOR-SURFACE MOUNT

## Series CE060




### FEATURES

- Surface mount
- Reflow soldering capability
- Miniature size (6.8 × 6.9 × 4mm)
- Light weight (0.8g)
- High reliability

### APPLICATIONS

Hand Held Telephone
Cordless Telephone
Interstage matching in microwave circuits

### PART NUMBERING

| CE | 060 | R836 | D | C | | 001 | – | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ | | | | ❽ |

❶ Series Name
❷ Model Number
❸ Center Frequency (express in GHz, R : indicate decimal point)
❹ Band Width
❺ Rated Power
❻ Signal Direction (Snecify A or B in Fig-1)
❼ Standard type has no number. (Additional numbers for special specification)
❽ Packaging Type TA1 : 178mm Dia. reel taping (250 pcs/reel)
TA2 : 330mm Dia. reel taping (1000 pcs/reel)
nothing : bulk

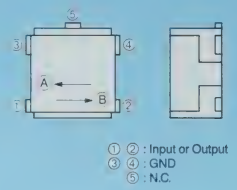


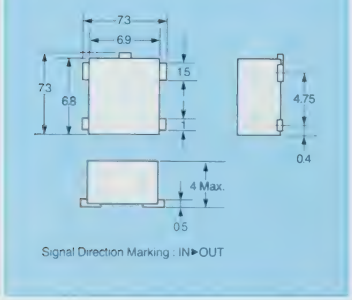

**Fig-1 : Terminal Location and Signal Direction (A or B)**

### SPECIFICATIONS

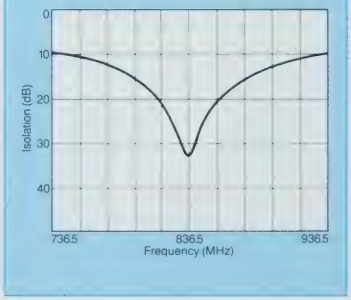
| Part Number | Frequency Range (MHz)* | Insertion Loss (dB) | Isolation (dB) | VSWR | Rated Power (W) | Reflected Power (W)** |
|---|---|---|---|---|---|---|
| CE060R836DC□ | 824 to 849 | 1.0 max. (−35 to +85°C) | 12 min. (−35 to +85°C) | 1.6 max. (−35 to +85°C) | 2.5 | 0.5 |
| CE060R888DC□ | 872 to 905 | | | | | |
| CE060R902DC□ | 890 to 915 | | | | | |
| CE060R911DC□ | 898 to 925 | | | | | |
| CE060R933CC□ | 925 to 942 | | | | | |

*Note : Other frequency range is also available on request. **Note : Case surface temperature should be less than 100°C.

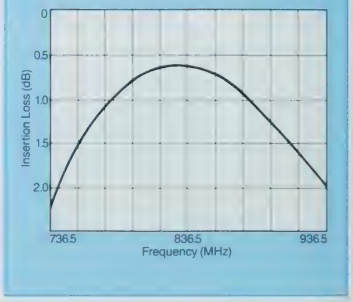
### DIMENSIONS: mm




### ISOLATION



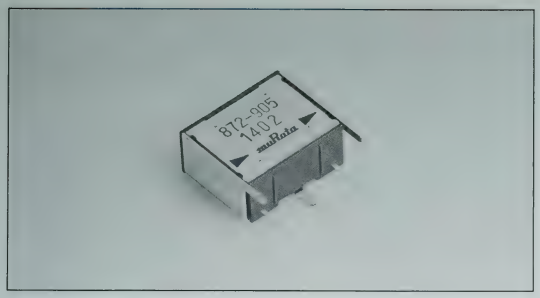

### INSERTION LOSS



# MICROWAVE ISOLATOR

muRata ERiE

## Series CE152




### FEATURES

- Small size (15 × 12.3 × 6.5mm)
- High reliability

### APPLICATIONS

Mobile Telephone
Cordless Telephone
Interstage matching in microwave circuits
Power protector for microwave test equipment

### PART NUMBERING

| CE | 152 | R836 | D | E | | 001 |
|---|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ | ❼ |

❶ Series Name
❷ Model Number
❸ Center Frequency (express in GHz, R : indicate decimal point)
❹ Band Width
❺ Rated Power
❻ Signal Direction (Specify A or B in Fig-1)
❼ Standard type has no number. (Additional numbers for special specification)

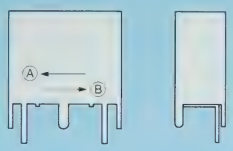


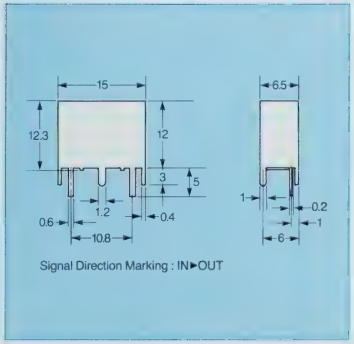

**Fig-1 : Terminal Location and Signal Direction (A or B)**

### SPECIFICATIONS

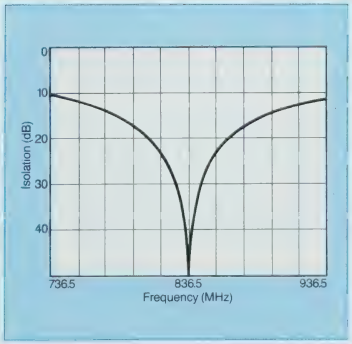
| Part Number | Frequency Range (MHz)* | Band Width (%) | Insertion Loss (dB) | Isolation (dB) | VSWR | Rated Power (W) | Reflected Power (W)** |
|---|---|---|---|---|---|---|---|
| CE152R836DE□ | 824 to 849 | Full | 0.7 max. (−35 to +85°C) | 13 min. (−35 to +85°C) | 1.5 max. (−35 to +85°C) | 10 | 3 |
| CE152R888DE□ | 872 to 905 | | | | | | |
| CE152R902DE□ | 890 to 915 | | | | | | |
| CE152R911DE□ | 898 to 925 | | | | | | |
| CE152R933CE□ | 925 to 942 | | | | | | |
| CE152R□E□ | 300 to 500 | 4 max. | 1.0 max. | 13 min. | 1.6 max. | | |
| | 500 to 800 | 3 max. | | | | | |

*Note : Other Frequency range is also available on request. **Note : Case surface temperature should be less than 100°C.

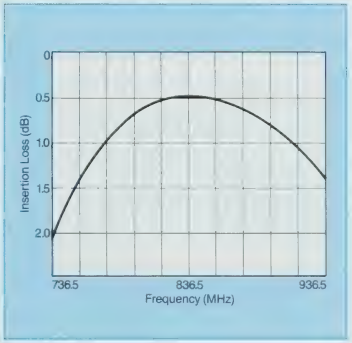
### DIMENSIONS: mm




### ISOLATION

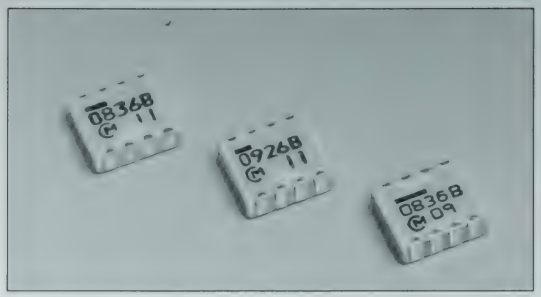



### INSERTION LOSS



# LC FILTER
# CHIP MONOLITHIC

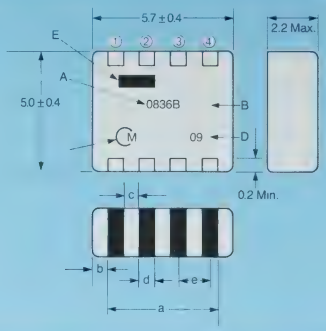
## LFC Series



### FEATURES

- Small size: (5.7×5×2) light weight: (0.2g)
- Metal shield is included on inner chip.
- Absolutely no adjustment required.
- Available in tape packaging.
- Available in frequency range from 750MHz to 1.15GHz.
- Reflow soldering is recommended.

### DIMENSIONS: mm




| Mark | Dimensions | Mark | Dimensions |
|---|---|---|---|
| a | 4.4±0.3 | d | 0.4 min. |
| b | 0.3 min. | e | 1.27±0.2 |
| c | 0.3 min. | f | 0.2 min. |

### MARKING

| | |
|---|---|
| A | Center Frequency (unit:MHz) |
| B | Filter Category (B:Pass Band filter) |
| C | Manufacturer's Name Code |
| D | Manufactured Date Code |
| E | Directional Input Mark |

### TERMINAL NUMBERING

| Terminal No. | Type | | Terminal No. | Type | |
|---|---|---|---|---|---|
| | 01 | 02 | | 01 | 02 |
| 1 | IN | IN | 5 | — | GND |
| 2 | GND | — | 6 | GND | — |
| 3 | GND | — | 7 | GND | — |
| 4 | OUT | OUT | 8 | — | GND |

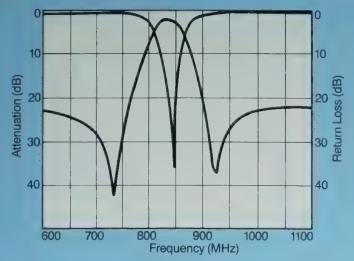
*Terminal "–" should not be connected to printed board.

### SPECIFICATIONS

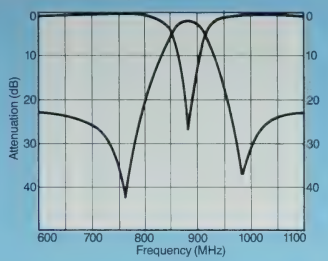
| Part Number | Center Frequency (Fo) | Operating Temperature Range | Characteristic Impedance | Pass Band Range | Insertion Loss in BW | Ripple in BW | Attenuation | V.S.W.R. in BW |
|---|---|---|---|---|---|---|---|---|
| LFC35-01B0836B025 | 836.5MHz | −30 to +85°C | 50Ω Nominal | Fo±12.5MHz | 3.5dB max. | 1.0dB max. | 20dB min. (Fo±77.5MHz) | 2.2 max. |
| LFC35-01B0881B025 | 881.5MHz | | | | | | | |
| LFC35-02B0836B025 | 836.5MHz | | | | 4.0dB max. | | 9dB min. (Fo+32.5MHz) | |
| LFC35-02B0881B025 | 881.5MHz | | | | | | 9dB min. (Fo−32.5MHz) | |

## TRANSMISSION vs. REFLECTION CHARACTERISTICS

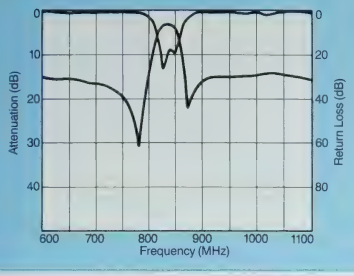
**LFC35-01B0836B025**



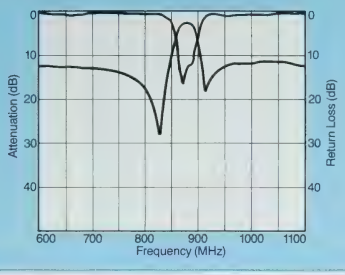

**LFC35-01B0881B025**



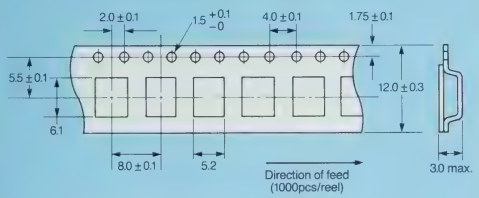

**LFC35-02B0836B025**

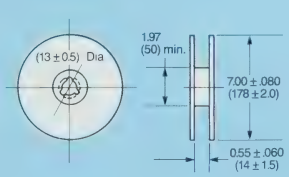



**LFC35-02B0881B025**




## DIMENSIONS, TAPE AND REEL: mm



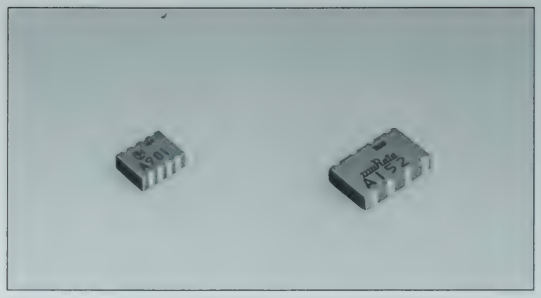




## ALSO AVAILABLE:

| | | |
|---|---|---|
| LFC35-01B0902B025 | LFC35-01B0947B025 | LFC35-01B0XXXB025 |
| LFC35-02B0902B025 | LFC35-02B0947B025 | LFC35-02B0XXXB025 |

# DELAY LINES
# CHIP MONOLITHIC

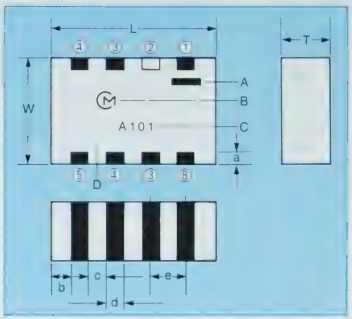
## LD Series



This delay line has been developed by combining chip multilayer and hole technology. It is comprised of a copper line and temperature compensated dielectric NPO (0±60ppm/°C) and includes a metal shield. This results in a very small device that is compatible with high frequency applications.

### APPLICATIONS
Optical Network Interface
Super Computer

### FEATURES
- High stability at high frequency 100MHz to 2GHz
- Multilayer construction results in a small, thin and light package
- Metal shield is built inside chip
- Reflow solderable
- Supplied on tape and reel




### DIMENSIONS: mm

| Dimension | LDH36 | LDH46 |
|---|---|---|
| L | 6.3 ±0.3 | 10.0 ±0.3 |
| W | 5.0 ±0.3 | 6.3 ±0.3 |
| T | 2.5 max. | 4.0 max. |
| a | 0.4 ±0.3 | 0.4 ±0.3 |
| b | 0.92 min. | 0.77 min. |
| c | 0.3 min. | 1.3 min. |
| d | 0.6 min. | 0.8 min. |
| e | 1.27±0.2 | 2.54±0.2 |

### TERMINALS

| Terminal No. | Function | Terminal No. | Function |
|---|---|---|---|
| ① | IN/OUT | ⑤ | IN/OUT |
| ② | GND | ⑥ | GND |
| ③ | GND | ⑦ | GND |
| ④ | GND | ⑧ | GND |

### PART NUMBERING

LD H36-01 A 101 A A

| Delay Line | Type | Impedance (A:50Ω) | Delay Time (Ex. 100pS → 101) | Delay Time Tolerance (A:±50pS B:±100pS) | Marking |
|---|---|---|---|---|---|

### MARKING

| | |
|---|---|
| A | Mark of input terminal |
| B | Symbol Marking |
| C | Delay Time (nominal value) |
| D | Impedance |

### ELECTRICAL SPECIFICATIONS – LDH36

| Part Number | Delay Time (nS)* | Impedance* | Rise Time | D.C. Resistance | Insulation Resistance | Rated Power | Operating Temperature Range |
|---|---|---|---|---|---|---|---|
| LDH36-01A101AB | 0.1±0.05 | 50Ω±10% | 0.1nS max. | 0.2Ω max. | 100MΩ min. | ¼W | −25 to +85°C |
| LDH36-01A201AB | 0.2±0.05 | | | 0.4 | | | |
| LDH36-01A301AB | 0.3±0.05 | | 0.15nS max. | 0.6 | | | |
| LDH36-01A401AB | 0.4±0.05 | | | 0.8 | | | |
| LDH36-01A501AB | 0.5±0.05 | | | 1.0 | | | |
| LDH36-01A601BB | 0.6±0.1 | | | 1.2 | | | |
| LDH36-01A701BB | 0.7±0.1 | | 0.2nS max. | 1.4 | | | |
| LDH36-01A801BB | 0.8±0.1 | | | 1.6 | | | |
| LDH36-01A901BB | 0.9±0.1 | | | 1.8 | | | |
| LDH36-01A102BB | 1.0±0.1 | | | 2.0 | | | |

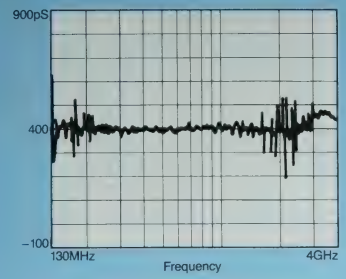
### LDH46 TYPE

| Part Number | Delay Time (nS)* | Impedance* | Rise Time | D.C. Resistance | Insulation Resistance | Rated Power | Operating Temperature Range |
|---|---|---|---|---|---|---|---|
| LDH46-01A501AA | 0.5±0.05 | 50Ω±10% | 0.2nS max. | 1.0Ω max. | 100MΩ min. | ¼W | −25 to +85°C |
| LDH46-01A102BA | 1.0±0.1 | | 0.3nS max. | 2.0 | | | |
| LDH46-01A152BA | 1.5±0.1 | | | 3.0 | | | |
| LDH46-01A202BA | 2.0±0.1 | | 0.4nS max. | 4.0 | | | |
| LDH46-01A252BA | 2.5±0.1 | | | 5.0 | | | |

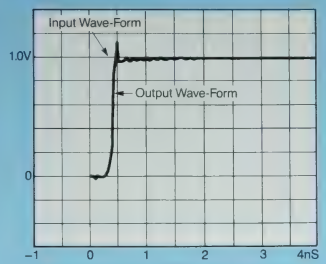
*Delay Time and Impedance are measured at 100MHz.

## TYPICAL RESPONSE CHARACTERISTICS

### GROUP DELAY



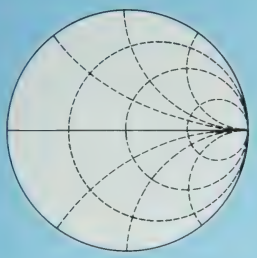

### PULSE RESPONSE



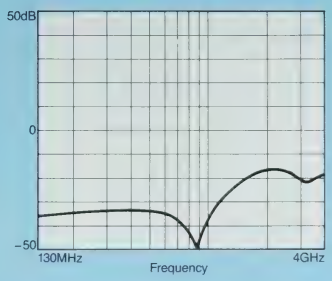

Test Sample: LDH36-01A401AB

### IMPEDANCE

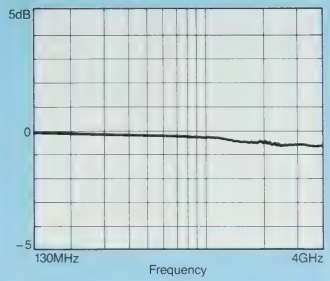
Frequency Range: 130MHz to 4GHz
(Smith Chart)



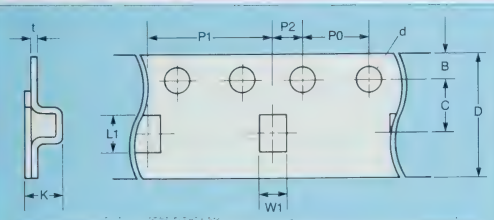
### RETURN LOSS



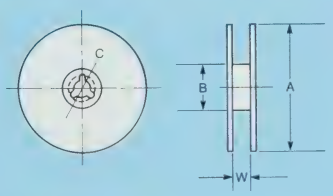

### INSERTION LOSS




## TAPE AND REEL SPECIFICATIONS




| Items | Code | Dimensions: mm | |
|---|---|---|---|
| | | LDH36 | LDH46 |
| Pitch of Sprocket Hole | P0* | 4.0±0.1 | |
| Position of Sprocket Hole | B | 1.75±0.1 | |
| Length from Hole Center to Component Center | C | 5.5±0.1 | 7.5±0.1 |
| Carrier Tape Width | D | 12.0±0.3 | 16.0±0.3 |
| Diameter of Sprocket Hole | d | 1.5±8.1 | |
| Pitch of Component | P1 | 8.0±0.1 | 12.0±0.1 |
| Length from Hole Center to Component Center | P2 | 2.0±0.1 | |
| | 40±0.3 at accumulated 10 pitches* | | |
| Length of Component | L1 | 6.9 | 10.6 |
| Width of Component | W1 | 5.6 | 6.9 |
| Total Thickness Tape and Chip | k | 3.0 | 3.7 |
| Base Tape Thickness | t | 0.4±0.1 | |




| Item | Dimensions: mm | |
|---|---|---|
| | LDH36 | LDH46 |
| A | 178±2.0 | 330±2.0 |
| B | 50 min. | 100 min. |
| C | 13±0.5 | |
| W | 12.5±1.5 | 17.5±1.5 |

*Please confirm the type and rated value upon ordering as they are subject to change for improvement without notice. Please contact us for further information.

# ANT Series

## FEATURES

- Utilizes high dielectric constant ($\varepsilon_r$ = approx. 21.4) and high Q magnesium titanate ceramic
- Integral GaAs FET LNA
- Excellent temperature performance
- Small size and low profile
- Wide directivity
- Low cost

## ELECTRICAL SPECIFICATIONS* – ANTENNA

| Model | ANT0008 / ANT0009** | ANT0017 |
|---|---|---|
| Center frequency | 1575.42MHz | 1580MHz |
| Polarization | R.H.C.P. | R.H.C.P. |
| Absolute gain | 0dBi min. above 20°<br>−5dBi min. for 5° to 20° | 0dBi min. above 20° elevation<br>−5dBi min. above 5° elevation |
| Axial ratio | 3dB max. for 90° | 3dB max. at 90° elevation |
| VSWR | 1.5:1 max. | 2:1 max. |
| Impedance | 50Ω | 50Ω |
| Bandwidth | 2MHz min. (VSWR ≤ 1.5:1) | 2MHz min. (VSWR ≤ 2:1) |

## ELECTRICAL SPECIFICATIONS* – LNA

| Model | ANT0008 / ANT0009 | ANT0017 |
|---|---|---|
| Center frequency | 1575.42MHz | 1575.42MHz |
| Power gain (P.G.) | 20dB min. | 20dB min. (except cable loss) |
| Noise figure | 1.5dB max. | 1.5dB max. (except cable loss) |
| VSWR | 2:1 max. | 2:1 max. |
| Impedance | 50Ω | 50Ω |
| Passband width | 20MHz min. (P.G. 3dB down) | 20MHz min. (N.F. ≤ 1.5dB) |
| Supply voltage | 5 ± 0.5V | 5±0.5V |
| Current consumption | 20mA max. | 20mA max. |

*At 20°C

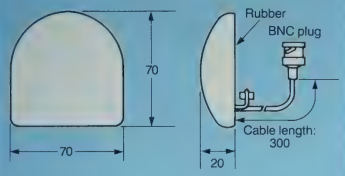
## SPECIFICATIONS – COMPLETE ASSEMBLY

| | | |
|---|---|---|
| Overall Dimensions | ANT0008 : 70mm × 70mm × 20mm<br>ANT0009 : 70mm × 70mm × 20.5mm | 42mm D × 13mm H |
| Operating Temperature Range | | −30°C to +85°C |
| Storage Temperature Range | | −40°C to +100°C |

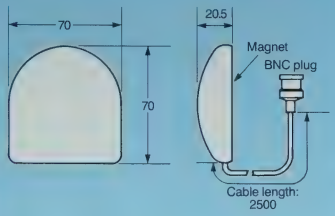
**Installed at the center of 90cm × 90cm ground plane

## DIMENSIONS: mm

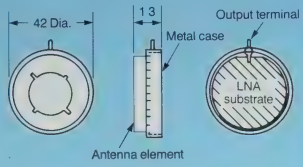
### ANT0008




### ANT0009

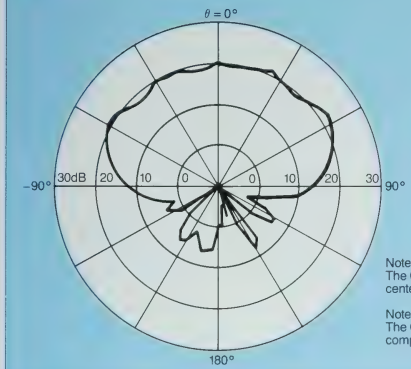



### ANT0017




## TYPICAL PERFORMANCE

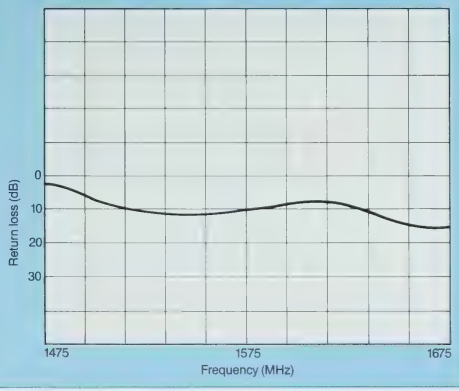
### ANT0008
### Radiation Pattern (with LNA)



Note 1:
The GPS antenna is installed on the center of 90cm×90cm ground plane.

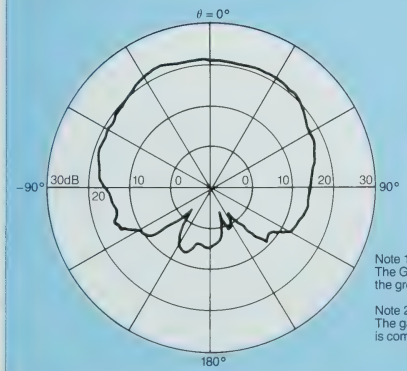
Note 2:
The GPS antenna gain with a LNA is comparison value with dipole antenna.

### Return loss




## TYPICAL PERFORMANCE

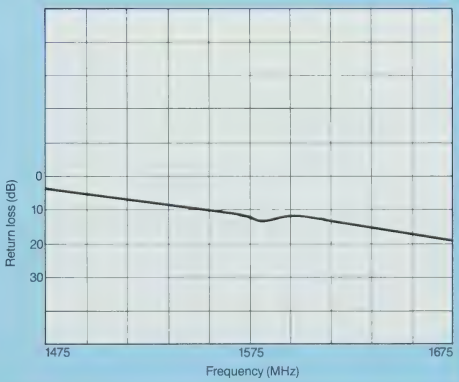
### ANT0017
### Radiation Pattern (with LNA)



Note 1:
The GPS antenna is not installed around the ground plane.

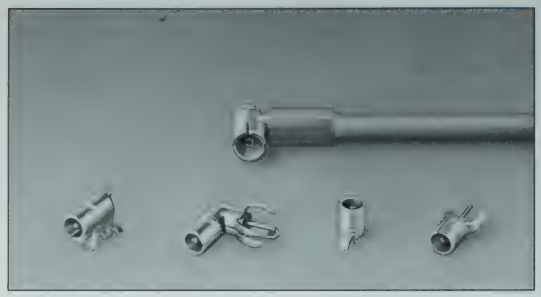
Note 2:
The gain of GPS antenna unit with a LNA is comparison value with dipole antenna.

### Return loss



# COAXIAL CONNECTORS
# MICRO MINIATURE

## BFA Series



### FEATURES
- Micro miniature and low profile
- Low leakage
- High performance at high frequencies
- Low price
- Available cable assembly
- Available for ultra-thin coaxial cables

### APPLICATIONS
Portable telephones, mobile telephones, cordless telephones, ocsilloscope, GPS, microwave equipment

### PART NUMBERING

| Part Number | Description |
|---|---|
| MM3325-2505 | Straight jack connector for printed circuits (with male contact) |
| MM3325-2507 | Straight jack connector with insulation spacer for printed circuits (with male contact) |
| MM3326-2506 | Right angle jack connector for printed circuits (with male contact) |
| MM3327-2514 | Straight plug receptacle for use on printed circuit boards—mates with MM3325-2505 |
| MXYH□□□□□□□□ | Right angle plug connector for flexible cables assembly (with female contact) See table on right. |

### ELECTRICAL SPECIFICATIONS

| Item | Rating |
|---|---|
| Voltage | 250V r.m.s. |
| Frequency | DC to 4GHz |
| | DC to 2GHz (MM3326-2506 and MM3327-2514 only) |
| Nominal Impedance | 50Ω |
| Temperature Range | –40°C to +90°C |
| Insulation Resistance | 1000MΩ |
| Contact Resistance | 10mΩ |
| Withstanding Voltage | 300VAC r.m.s. |
| V.S.W.R. | 1.2 Maximum |

### MATERIALS AND FINISH

| Part Name | Materials | Finish |
|---|---|---|
| Center Contact | Berylium copper or Brass | Gold plated |
| Outer Contact | Phosper bronze | Silver plated or Nickel plated |
| Insulator | Poly-phenylene sulfide or Poly-butylen terephthalate | None |
| Outer Sleeve | Brass | Zinc plated |

### PART NUMBERING FOR CABLE ASSEMBLY

| MX | YH | 62 | XX | 200 | 0 |
|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ |

❶ Cable assembly

❷❹ Cable termination connector code

| Number | Connector |
|---|---|
| YH | MM3621-5901 |
| XX | No Connector |

❸ Cable number

| Number | Cable | Outer Diameter | Outer Conductor |
|---|---|---|---|
| 62 | 0.8D-QEW | 2.5 mm | Double sealed |
| 63 | 0.8D-QEV | 2.0 mm | Single sealed |

❺❻ Full length of cable assembly

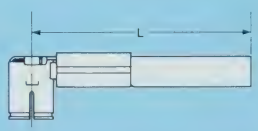
Length L (mm) = ❺ $\times 10^{❻}$

Ex. 100mm = $10^{0} \times 100 \rightarrow 1000$

500mm = $500 \times 10^{0} \rightarrow 5000$

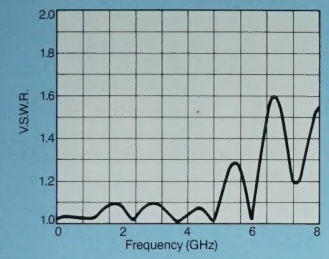
1000mm = $100 \times 10^{1} \rightarrow 1001$

### FULL LENGTH TOLERANCE



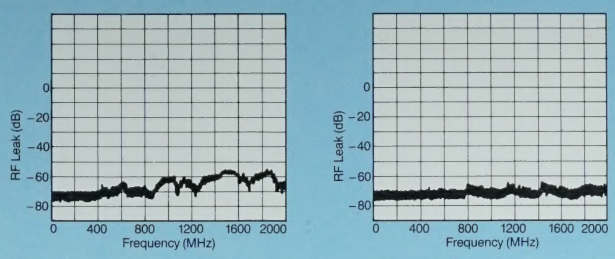

| Full Length (mm) | | Dimensional Tolerance (mm) |
|---|---|---|
| Over | Max. | |
| 50 | 100 | ± 3 |
| 100 | 500 | ± 4 |
| 500 | 1000 | ±10 |
| 1000 | — | $^{+2}_{0}$% |

## TYPICAL V.S.W.R.




MM3325-2505+MXYH□□□□□□□□

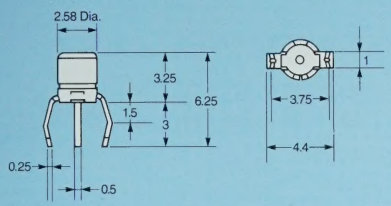
## TYPICAL RF LEAKAGE



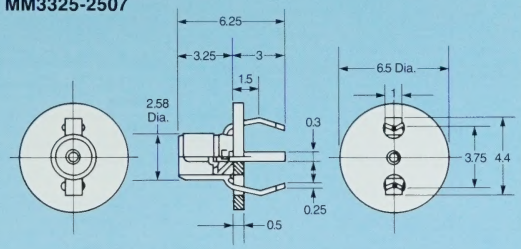

MM3325-2505+MXYH□□□□□□□□

## DIMENSIONS: mm

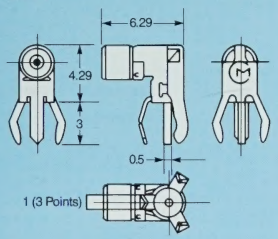
### MM3325-2505



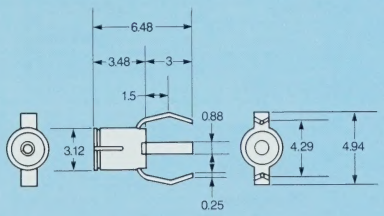

### MM3325-2507




### MM3326-2506

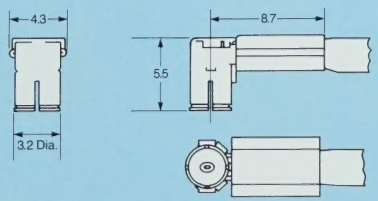



### MM3327-2514




## DIMENSIONS: mm

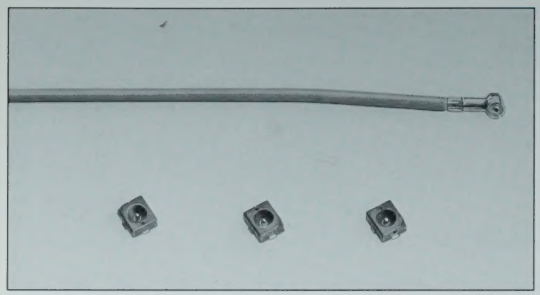
MXYH□□□□□□□□




(This part number uses MM3621-5901 connector.)

# COAXIAL CONNECTORS
# SMT, MICRO MINIATURE

## CCR Series



### FEATURES
- Micro miniature, low profile (4.2mm max.)
- For SMT and reflow soldering
- Tape and reel available
- High performance (V.S.W.R. 1.2 max. at 2GHz)
- Available for ultra-thin coaxial cables

### APPLICATIONS
Portable telephones, mobile telephones, cordless telephones, GPs, other microwave equipment

### PART NUMBERING

| Part Number | Description | Packaging | Quantity |
|---|---|---|---|
| MM4329-2700 | Straight receptacle for printed circuit board. (Center contact shape : Pin) | Bulk package | Free |
| MM4329-2700TB1 | | 178mm reel | 500pcs/reel |
| MM4329-2700TB2 | | 330mm reel | 3000pcs/reel |
| MXSG63□□□□□□ | Right angle cable assembly with flexible cable. (Center contact shape : Socket | — | |

### ELECTRICAL SPECIFICATIONS

| Item | Rating |
|---|---|
| Voltage | 250V r.m.s. |
| Frequency Rating | DC to 2GHz |
| Nominal Impedance | 50Ω |
| Temperature Range | −40°C to +90°C |
| Insulation Resistance | 500MΩ Minimum |
| Contact Resistance | 15mΩ Maximum |
| Withstanding Voltage | 300VAC r.m.s. |
| V.S.W.R. | 1.2 Maximum |

### MATERIALS AND FINISH
MM4329-2700

| Part Name | Materials | Finish |
|---|---|---|
| Center Contact | Stainless Steel | Gold plated |
| Outer Contact | Stainless Steel | Gold plated |
| Insulator | Poly-phenylene Sulfide | None |

MXSG63□□□□□□

| Part Name | Materials | Finish |
|---|---|---|
| Center Contact | Beryllium Copper | Gold plated |
| Outer Contact | Phospher Bronze | Gold plated and Nickel plated |
| Insulator | Fiber Reinforced Polypropylene | None |

### PART NUMBERING FOR CABLE ASSEMBLY

| MX | SG | 62 | XX | 200 | 0 |
|---|---|---|---|---|---|
| ❶ | ❷ | ❸ | ❹ | ❺ | ❻ |

❶ Cable assembly

❷❹ Connector code

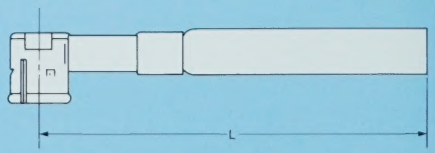
| Number | Connector |
|---|---|
| SG | CCR type Plug connector |
| XX | No Connector |

❸ Cable number

| Number | Cable | Outer Diameter | Outer Conductor Construction | Minimum Bending Radius |
|---|---|---|---|---|
| 63 | 0.8D-QEV | 2.0 mm | Single sealed | 8mm |

❺❻ Full length of cable assembly
Length L (mm) = ❺ $\times 10^{❻}$
Ex. 500mm = $500 \times 10^{0} \rightarrow 5000$
1000mm = $100 \times 10^{1} \rightarrow 10001$

### FULL LENGTH TOLERANCE

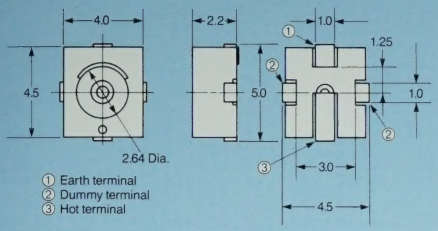



| Full Length (mm)* | | Dimensional Tolerance (mm) |
|---|---|---|
| Over | Max. | |
| 50 | 100 | ± 3 |
| 100 | 500 | ± 4 |
| 500 | 1000 | ±10 |
| 1000 | — | Total Length $^{+2}_{0}$% |

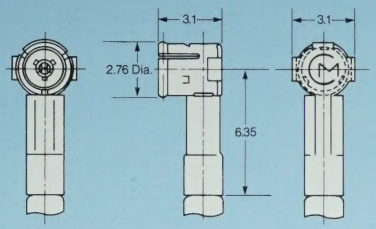
*L=50mm Min.

## DIMENSIONS: mm

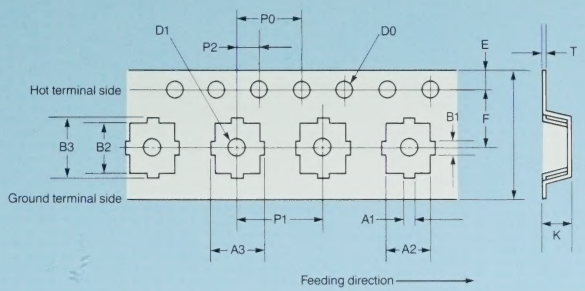
**MM4329-2700**




**MXSG63□□□□□□**




## TAPE DIMENSIONS: mm



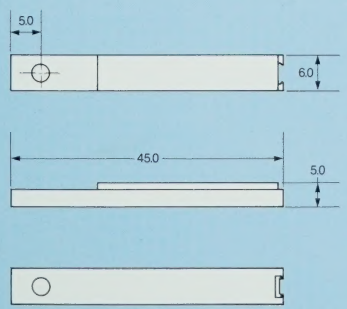

| A1 | A2 | A3 | B1 | B2 | B3 | W | D0 | D1 |
|---|---|---|---|---|---|---|---|---|
| 1.4 | 4.2 | 5.2 | 1.4 | 4.7 | 5.7 | 12±0.2 | $\phi 1.5^{+0.1}_{0}$ | 1.5MIN. |

| E | F | K | P0 | P1 | P2 | T |
|---|---|---|---|---|---|---|
| 1.75±0.1 | 5.5±0.1 | 2.6±0.1 | 4±0.1 | 8±0.1 | 2±0.1 | 0.3 |

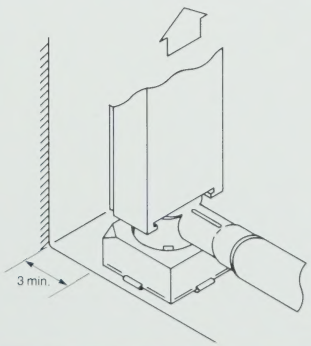
A1, A2, A3, B1, B2 AND B3 are the bottom dimensions of the cavity.

## DISENGAGEMENT TOOL

**M17000**




**DISENGAGEMENT TOOL APPLICATION**



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